



THE EFFECTS OF INTRAARTICULAR AND PERIARTICULAR KNEE PAIN MANAGEMENT ON THE REHABILITATION OF PATIENTS WITH KNEE OSTEOARTHRITIS AFTER CEPHALOMEDULLARY FIXATION OF PERTROCHANTERIC FRACTURES

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SUMMARY — The gold standard for pertrochanteric fractures is closed reduction with traction and intramedullary osteosynthesis. A significant number of patients report knee pain after surgery, which could be associated with gonarthrosis and traction. In this research we wanted to determine if managing knee pain affects the rehabilitation of patients. There were three groups: the first group received a post-operative intra-articular (IA) injection containing methylprednisolone with lidocaine; the second group received the same combination periarticularly (PA); and the control group did not receive any form of injection. We measured the Visual Analogue Scale (VAS) score on the 3rd and 12th postoperative days, as well as six weeks after surgery. We measured knee range of motion (ROM) on the 12th postoperative day and six weeks after surgery. We calculated the Harris Hip Score (HHS) on the 3rd day and six weeks postoperatively. There were 27 patients. Preoperative Kellgren-Lawrence and VAS pain scores were similar. The IA group demonstrated the lowest VAS pain score after six weeks. ROM did not improve between groups on the 12th day and six weeks postoperatively. HHS was best in the IA group after 6 weeks. Injection of methylprednisolone with lidocaine into the knee improved postoperative rehabilitation in patients with knee osteoarthritis undergoing ipsilateral cephalomedullary fixation for a pertrochanteric fracture.

Keywords: *Pertrochanteric fracture; Knee osteoarthritis; Knee pain; Skeletal traction; Knee injection*

Introduction

Hip fractures in elderly patients result from simple falls from standing height. Anatomically, they are subdivided into intracapsular (i.e. at the femoral neck) and extracapsular fractures. Extracapsular fractures are further subdivided into pertrochanteric and

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subtrochanteric fractures¹. Most of the hip fractures (>90%) occur in patients older than 65, and represent an important cause of morbidity and mortality. The incidence of such fractures is expected to increase markedly with the aging of the population, up to an estimated more than 6 million during the next 30 years².

Pertrochanteric fractures are extracapsular hip fractures classified as Type 31-A1 and A2 by the Arbeitsgemeinschaft für Osteosynthesefragen/Orthopedic Trauma Association, with the main fracture line running obliquely from proximal-lateral to distal-medial. The A1 group represents a simple type of two-part fractures, while the A2 group represents multifragmentary fractures. This latter group is further divided into subgroups 2.1, 2.2 and 2.3, which denote progression from a simpler fracture with a small lesser trochanteric fragment to a highly multifragmentary fracture involving the lesser and greater trochanters³.

Nonoperative treatment of pertrochanteric fractures is rare but may still have a role in non-ambulatory patients in whom adequate pain control can be achieved without surgery. Internal fixation is appropriate for most pertrochanteric fractures. The mainstay of treatment is fixation with an SSP (sliding screw plate) device or intramedullary device¹.

Rehabilitation after cephalomedullary fixation starts, if possible, on the day of surgery, and the patient is allowed to stand up and weight-bear as soon as able. The achieved fixation should aim to permit full weight-bearing immediately after surgery¹.

A considerable number of patients report knee pain after surgical treatment of pertrochanteric fractures. Abnormal stress to the knee joint at the time of injury or operation (traction, vibration, and impaction) is one of the possible etiological factors that can lead to acute exacerbation of knee osteoarthritis^{5,6}. It has been previously described that symptomatic knee joint effusion is common in elderly patients following ipsilateral hip osteosynthesis⁷. Furthermore, intertrochanteric fractures affect knee pain after hip osteosynthesis more than femoral neck fractures, particularly in unstable patterns⁸. Finally, we cannot disregard that biological age-related changes of joint structures, together with exposure to various risk factors, result in an increased incidence of knee osteoarthritis with age⁹.

Knee pain negatively affects the patient's ability to start early rehabilitation after surgical treatment of

hip fractures. Failing to mobilize is associated with an increased risk of developing complications, postoperative delirium, as well as decreased physical function and quality of life^{10,11}. Thus, careful examination and management of knee pain are needed in patients with hip fracture surgery⁸.

Intraarticular corticosteroid injection of the knee is a well-established procedure with evidence showing effectiveness in improving pain, knee flexion and extension, knee circumference and morning stiffness. Pain relief and functional improvement are significant for months and up to one year after the injection¹².

Since cartilage tissue lacks sensory nerves, pain in the early stages of the disease originates in soft tissues. Periarticular infiltration of corticosteroids is an alternative method of local administration in knee grade 1–3/4 osteoarthritis¹³.

The hypothesis of this study is that local analgesic therapy for osteoarthritic knees will improve rehabilitation and recovery in patients operated on for ipsilateral pertrochanteric fracture.

The aim of this study was to determine whether local analgesic therapy consisting of corticosteroid and lidocaine injected intraarticularly or periarticularly can prevent knee pain and improve rehabilitation and recovery in patients operated for pertrochanteric fracture, and to determine whether there are any differences between intraarticular and periarticular application of the mentioned combination of drugs.

Materials and Methods

After having obtained Ethical Board approval, this prospective cohort study was conducted from February 2022 to March 2023 at University Clinical Hospital Mostar, Bosnia and Herzegovina.

We included patients with pertrochanteric fractures, aged over 60 years, with primary knee osteoarthritis Kellgren-Lawrence stage II, III or IV, with a slightly to moderately painful knee preoperatively (up to 5 out of 10 on the Visual Analogue Scale [VAS]). We excluded immobile patients, patients with rheumatoid arthritis or another systemic illness, patients with malignancy, patients with previous surgeries on the lower extremities and patients with other fractures besides the hip.

Patients from the first group received post-operative intra-articular injection of 40 mg of methylprednisolone acetate together with 2 ml of 2% lidocaine (Group IA); the second group received periarticular infiltration postoperatively with the same combination of drugs (Group PA); finally, there was a control group of patients who did not receive any form of local analgesic therapy.

In the intraarticular group, the skin was cleaned with two 70% alcohol swabs, followed by two betadine swabs. We used 18-Fr needles. The puncture site was 1 cm above and 1 cm down from the bottom line of the patella. The joint was first aspirated and then injected with the combination of drugs.

In our study, we performed genicular nerve block periarticularly. A genicular nerve block is a procedure where these nerves are anesthetized ("blocked") with a local anesthetic injected through small needles. The procedure was performed under ultrasound guidance to ensure proper needle placement. A small amount of local anesthetic (1-2 ml) of lidocaine or bupivacaine was injected around the superior lateral (SL), superior medial (SM) and the inferior medial (IM) branches. The procedure was conducted with appropriate aseptic precautions.

In all groups, we measured VAS on the 3rd and 12th postoperative day, as well as 6 weeks after the surgery. We measured the knee range of motion (ROM) on the 12th postoperative day and 6 weeks after the surgery. The clinical outcome was assessed using the Harris Hip Score (HHS), which we calculated on the 12th postoperative day and 6 weeks postoperatively using a publicly available online tool available from www.orthotoolkit.com.

We used LimaCorporate S.p.A (Villanova, San Daniele del Friuli, Italy) Chiodo SuperNail GT Standard 130° on all our surgeries. Surgery was done according to the manufacturer's manual.

Surgical technique: the patient is placed supine on a fracture table with a perineal post. The affected leg is placed in a boot-traction device, and the contralateral, uninjured leg is placed on a leg holder. The perineal post is placed for the stability of the pelvis. Traction is applied to the leg to reduce the fracture, usually together with slight internal rotation in the hip. The reduction is confirmed with fluoroscopy. Then, the skin is incised for about 5 cm proximal to the tip of

the greater trochanter. Centered on the skin mark, a similar incision is made on the fascia of the gluteus muscle, continuing to the fascia lata distally. Fibers of the gluteal muscles are bluntly split to gain access to the tip of the trochanter. The entry point for the cephalomedullary nail is located slightly medial to the tip of the greater trochanter. After proximal reaming, a guide wire is inserted and advanced through the femoral shaft. The medullary nail is inserted manually using the insertion handle. After insertion of the nail, another small skin incision is made to place the drill sleeve for the lag screw, which is advanced over the guiding K-wire in an adequate fluoroscopy-confirmed position. The lag screw is secured in an appropriate position using an anti-rotational screw through the nail. The additional distal interlocking screw is placed through an appropriate sleeve mounted on the nail insertion handle.

All collected data were entered into Microsoft Excel (Microsoft Office Excel 2019). Statistical analysis was performed using SPSS for Windows 26.0 (SPSS, Chicago, IL). All continuous data were expressed as mean \pm standard deviation. The data distribution for continuous variables was determined using the Kolmogorov-Smirnov test. Distribution was normal, so the statistical significance of continuous variables between groups was analyzed using the one-way ANOVA test.

Results

A total of 27 patients were included in the study, of whom 82% were women. The patients were evenly distributed among the three groups. The average age was 81.3 ± 7.5 years. The patients' Kellgren-Lawrence score was 2.9, 3.4 and 3.6 for the control, intra-articular (IA) and periarticular (PA) groups, respectively ($p=0.134$).

The preoperative VAS pain scale was similar among groups, but postoperative VAS scores were significantly reduced among the IA and PA groups. There was no difference in VAS scores between the IA and PA groups (Table 1).

There were no statistically significant differences between the knee ROM among the groups on the 3rd day and 6 weeks after the surgery (Table 2).

Table 1. Comparison of the VAS pain scale between groups from preoperative until 6 weeks post-surgery

	VAS pre-op	VAS 3 rd day	VAS 12 th day	VAS 6 weeks post-op
Control	3.9	4	3.8	3.8
IA	4.5	1.7	1.8	2.3
PA	4.6	2.4	2.4	2.9
p	0.293*	0.001**	0.002**	0.034**

*One-way ANOVA; **One-way ANOVA with Bonferroni post-hoc correction; VAS = Visual Analogue Scale; IA = intra-articular; PA = periarticular

Table 2. Comparison of knee ROM on the 3rd day and 6 weeks post-surgery

	ROM 3 rd day	ROM 6 weeks post-op
Control	104	107
IA	100	105
PA	103	107
p	0.885*	0.933*

*One-way ANOVA; ROM = range of motion; IA = intra-articular; PA = periarticular

On the third postoperative day, the HHS was similar among groups, but after 6 weeks, the PA and especially IA patients did much better than the control group (Table 3).

Table 3. Comparison of HHS on the 3rd day and 6 weeks post-surgery

	HHS 3 rd day	HHS 6 weeks post-op
Control	20 ± 6	39 ± 5
IA	28 ± 10	53 ± 13
PA	21 ± 8	45 ± 11
p	0.157*	< 0.05*

*Kruskal-Wallis test; HHS = Harris Hip Score; IA = intra-articular; PA = periarticular

Discussion

To evaluate the functional outcomes of intramedullary nail fixation in pertrochanteric hip fractures, we used the modified HHS as it has adequate construct validity, internal validity and responsiveness¹⁴.

Our research showed interesting results in VAS scores for knee pain between the three groups. Three days after surgery, IA knee injections showed a better effect than PA injections compared to the control group. After twelve days, the IA group still reported less pain than the PA group. Six weeks postoperatively, the IA group still demonstrated significantly lower VAS scores, although the difference diminished. These results demonstrate good short-term results in treating knee pain after hip fracture surgery with both IA and PA corticosteroid/lidocaine injections, while IA seems to be more effective. Contrary to our results, research conducted by Cheng *et al.* found that PA injections were more effective in reducing knee pain and increasing the ROM after total knee arthroplasty (TKA). Their research agrees with a cadaveric study, which found that the outer knee capsule had greater innervation than the inner knee¹⁵. We also agree that the knee capsule has greater innervation. However, these were the results after TKA. Cartilage inside the joint is the most damaged, which explains why we got better results with IA injections¹⁶.

We tested the knee ROM on the 12th postoperative day, as well as 6 weeks postoperatively, and found no statistical difference between the control, IA and PA groups. It should be taken into account that we have excluded immobile patients and included only patients with slight to moderate knee pain (up to 5/10 on VAS) and that more than half of the study participants

were categorized as Kellgren–Lawrence 3 or less. With that in mind, it is not surprising that most participants demonstrated similar knee movement, with a ROM coinciding with previous literature¹⁷.

Our results showed that the IA group had better HHS on the third postoperative day, but the difference was not statistically significant. After 6 weeks, the difference became significant. If the cause of knee pain after pertrochanteric fracture management is indeed an acute exacerbation of knee osteoarthritis as described in the introduction, it would make sense that an injection of corticosteroid and lidocaine can offer quicker mobilization in the early postoperative phase. Relieving knee pain improved the functional outcome and induced better patient rehabilitation.

Finally, we can conclude that injection of methylprednisolone acetate together with lidocaine to the knee joint has a clear role in improving postoperative rehabilitation in patients with primary knee osteoarthritis undergoing ipsilateral cephalomedullary fixation for a pertrochanteric fracture.

Conclusions

1. Local analgesic therapy, consisting of corticosteroid and lidocaine injected intraarticularly or periarticularly, can prevent knee pain and improve rehabilitation and recovery in patients operated on for pertrochanteric fracture.
2. Intraarticular analgesic therapy of methylprednisolone acetate and lidocaine is superior to periarticular.

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Sažetak

UČINCI INTRAARTIKULARNE I PERIARTIKULARNE TERAPIJE BOLI U KOLJENU NA REHABILITACIJU BOLESNIKA S OSTEOARTRITISOM NAKON INTRAMEDULARNE FIKSACIJE PERTROHANTERNIH FRAKTURA

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Zlatni standard liječenja pertrohanternih fraktura je zatvorena repozicija pomoću trakcije s intramedularnom osteosintezom. Velik broj pacijenata imao je bol u koljenu nakon operacije što bi moglo biti povezano s gonartrozom i trakcijom. U ovom radu željeli smo istražiti može li smanjenje boli u koljenu utjecati na ishod rehabilitacije pacijenata. Pacijenti su podijeljeni u tri skupine. Prva skupina dobila je post-operativnu intraartikularnu (IA) injekciju metilprednizolona s lidokainom, druga skupina primila je istu kombinaciju periartrikularno (PA), a kontrolna skupina nije dobila nikakvu injekciju. Izmjerali smo vizualno-analognu skalu (VAS) boli treći i dvanaesti postoperativni dan, te 6 tjedana nakon operacije. Izmjerali smo opseg pokreta (ROM) dvanaesti postoperativni dan i 6 tjedana nakon operacije. Izračunali smo Harris Hip Score (HHS) treći postoperativni dan i 6 tjedana nakon operacije. U istraživanju je sudjelovalo 27 pacijenata. Preoperativni Kellgren-Lawrence i VAS skala bili su slični. IA skupina imala je najniži VAS rezultat nakon 6 tjedana. ROM se nije značajno povećao dvanaesti dan ni 6 tjedana nakon operacije. HHS je bio najbolji u IA skupini 6 tjedana nakon operacije. Injekcija metilprednizolona s lidokainom u koljeno poboljšala je postoperativnu rehabilitaciju pacijenata s gonartrozom kod kojih je učinjena intramedularna osteosinteza pertrohanterne frakture na istoj strani.

Ključne riječi: Pertrohanterna fraktura; Osteoartritis koljena; Bol u koljenu; Skeletalna trakcija; Injekcija u koljeno