



## Is cold therapy really efficient after knee arthroplasty?



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### HIGHLIGHTS

- Cold therapy is effective in terms of the pain control and knee scores.
- Cold therapy does not lead to significant changes in intraoperative and postoperative bleeding.
- Cold therapy does not affect the hemoglobin values.

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### ABSTRACT

**Introduction:** Knee arthroplasty is a frequently used surgery. The purpose of this study is to evaluate the effects of cold therapy after knee arthroplasty.

**Methods:** 60 patients who were operated in our clinic between the years 2013 and 2014 were evaluated prospectively, and the patients were randomized into two groups. The cold therapy by Cryo/Cuff application was started 2 h before the surgery in Group-2 patients; it was repeated in a postoperative 6th hour and continued for postoperative four days. We analyzed the visual analog scales (VAS) for pain, Knee Society Scores (KSS), hemoglobin, and bleeding parameters.

**Results:** The data of the group that did not receive the Cryo/Cuff application (Group-1) are as follows; the number of the patients was 33; the mean age value was 68.4 (53–78). Group-2 data was as follows; the number of the patients was 27; the mean age value was 67.2 years (range 57–78). The mean KSS scores of the patients increased from 79.6 (75–83) and to 90.5 (88–92) postoperatively ( $p < 0.05$ ).

**Discussion:** In our study, the pain and functional knee scores of the patients who received Cryo/Cuff application were significantly different and as expected, the use of analgesics was much lower. Cryotherapy did not affect the amount of bleeding during the surgery ( $p > 0.05$ ), which was not reported previously in the literature.

**Conclusion:** After knee arthroplasty, the preoperative and postoperative use of cryotherapy is effective in terms of the pain control and functional knee scores without a significant change in surgical blood loss.

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Knee arthroplasty is a routinely performed orthopedic procedure to improve mobility and obtain pain relief in the affected lower limb [1]. The pain together with the edema and blood loss are the early postoperative problems after knee arthroplasty [2]. The prevention of pain and reduction of surgical blood loss will provide a better orientation of the patient to the rehabilitation period. The patients will be able to use the extremity in a faster way, and the hospitalization time will be reduced. The analgesic drugs, morphine and epidural analgesia and cold therapy are the preferred alternatives for the pain control.

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Cold therapy has clinical applications in pain control since the 1960s [3]. This therapy passes the cold soft tissues and decreases the intra-articular temperature; slows down the nerve conduction velocity, also slows down the blood flow with vasoconstriction and makes the pain and edema become smaller [4,5]. In the literature, there are plenty of papers that they mentioned about the effectiveness of the cold therapy after soft tissue and sports injuries [4,6]. However, the literature is scarce regarding the effects of perioperative cold therapy.

The objective of this study is to evaluate the effects of cold therapy on the pain, bleeding amount from the drainage tube, hemoglobin levels, blood transfusion needs and the postoperative rehabilitation period in patients with knee arthroplasty.

## 1. Methods

60 patients who were operated in our clinic between the years 2013 and 2014 were evaluated prospectively. The inclusion criteria of the study was indication for knee arthroplasty due to the presence of advanced primary knee osteoarthritis. Presence of comorbidities that are contraindications for cold therapy (diabetes mellitus, bleeding diathesis and vascular occlusion) was accepted as exclusion criteria. The patients were grouped into 2 groups in random order, and the patients were allocated to the study or control group according to a computer-generated list; the 1st Group did not receive the cryo/cuff therapy in the postoperative period. The cryo/cuff (*Waegener cryocephical treatment server*) (Fig. 1) was applied to the 2nd Group in the postoperative period. All patients had primary osteoarthritis and unicondylar or total knee arthroplasty applied to them according to their knee osteoarthritis status. Fifteen patients were operated with unicondylar knee arthroplasty (Group-1: 9 patients, Group-2: 6 patients); and 45 patients were operated with total knee arthroplasty (Group-1: 24 patients, Group-2: 21 patients). The same surgeon who was experienced in arthroplasty operated all the patients arthroplasty with the same surgical technique. The patients were administered 1 gr/iv Cefazolin 1 h before the surgery. All patients were operated under general anesthesia.

The Cryo/Cuff application was started 2 h before the surgery in Group-2 patients; it was repeated in postoperative 6th hour, and it was applied to the patients for 2 h every day, during postoperative 4 days (Fig. 2). The Continuous Passive Motion (CPM) device was started for all groups on the postoperative first day, and it was ensured that the time and level were the same. CPM is one of the postoperative rehabilitation devices that we routinely use to gain the flexion and extension of the knee postoperatively. The drainage tube was used intraoperatively to remove the unnecessary blood from the knee joint, and it was taken out on the postoperative first day. The Knee Society Scoring System (KSS) was used to evaluate knee function after knee arthroplasty. KSS evaluates the patient's pain, total range of flexion (flexion contracture and extension lag-if present) and stability [7] and is graded scores as; below the 60 points-poor and above the 80-excellent. The hemoglobin values and VAS scores were assessed preoperatively and on first, third and



Fig. 2. 64 years old male patient Cryo therapy application after total knee arthroplasty.

fifth postoperative days. The patients were discharged on the postoperative fifth day. None of the patients had reactive skin damage or problems in the healing of the wounds.

All patients were followed up at least 12 months however we analyzed the early effects of the cold therapy for this reason in this report we mentioned preoperatively and early postoperative results. KSS scores assessed the impact of the cryotherapy on the knee functions. VAS assessed the perceived pain and relatively the analgesic need. Hemoglobin values and the amount of bleeding from the drainage tube were used to evaluate the vasoconstrictive effect of cryotherapy.

### 1.1. Statistical analysis

For the analysis of the parametric variables were used one-way analysis of variance, whereas the values within the groups were compared using the parametric paired t-test and the Wilcoxon test was used. The ( $p < 0,05$ ) value was accepted statistically significant for all statistical analyzes. The groups were randomized



Fig. 1. Waegener cryo/cuff treatment server.

**Table 1**Hemoglobin values of the groups,  $p > 0.05$  for all days.

	Hb preoperative (mmol/dL)	Hb postoperative day-1 (mmol/dL)	Hb postoperative day-3 (mmol/dL)	Hb postoperative day-5 (mmol/dL)
Group-1	12.8 (10–14.6)	10.8 (8.3–12.5)	9.3 (7–12.8)	9 (8.4–10.5)
Group-2	12.5 (11.5–14.8)	10.3 (8.9–12.1)	9.6 (7.4–11.4)	9.1 (8.5–10.1)

**Table 2**Visual pain score values of the groups,  $p < 0.05$  for all days.

	VPS- preoperative	VPS postoperative day-1	VPS postoperative day-3	VPS postoperative day-5
Group-1	4.5	3.6	3.3	3.3
Group-2	2.1	2.7	2.5	3

**Table 3**

Average knee society function scores of the groups.

	KSS- preoperative	KSS postoperative
Group-1	75.5 (65–82)	80.3 (77–86)
	Pain sub-scores: 35 (20–40)	Pain sub-scores: 40 (20–45)
	ROM sub-scores: 7 (5–21)	ROM sub-scores: 13 (8–20)
	Stability sub-scores: 15 (5–25)	Stability sub-scores: 20 (5–25)
Group-2	79.6 (75–83)	90.5 (88–92)
	Pain sub-scores: 35 (25–40)	Pain sub-scores: 45 (25–50)
	ROM sub-scores: 9 (5–22)	ROM sub-scores: 17 (10–23)
	Stability sub-scores: 15 (10–25)	Stability sub-scores: 20 (10–25)
	$P < 0.05$	$P < 0.05$

incidentally. Each group included more than seven patients to achieve the significant results. All analyzes were performed using SPSS 19.0 for Windows, with a confidence level of 95%.

## 2. Results

The data of the group that did not receive the Cryo/Cuff application (Group-1) are as follows; the number of the patients were 33; the mean age value was 68.4 (53–78), the mean hemoglobin values were as 12.8 mmol/dL, 9 mmol/dL on the preoperative and postoperative 5th day, respectively (Table 1). The mean VAS scores values 4.5 and 3.3 on the preoperative and postoperative fifth day, respectively (Table 2). The mean KSS scores of the patients were in; 75.5 preoperatively and 80.3 postoperatively. The mean total fluid coming from the *drainage tube* was 400.4 cc. The mean intraoperative bleeding amount was 114 cc.

The data of the group that received the Cryo/Cuff application (Group-2) were as follows; the number of the patients was 27; the mean age was 67.2 years (57–78), the mean hemoglobin values were 12.5 mmol/dL, 9.1 mmol/dL on the preoperative and postoperative fifth day, respectively (Table 1). The mean VAS scores were 2.1 and 3 ( $p < 0.05$ ) on the preoperative and postoperative fifth day, respectively (Table 2). The mean KSS scores of the patients were 79.6 preoperatively and 90.5 postoperatively ( $p < 0.05$ ) (Table 3). The mean amount of the fluid coming from the *drainage tube* was 365 cc. The mean intraoperative bleeding amount was 116 cc ( $p > 0.05$ ) (Table 4).

Unicondylar arthroplasty and total knee arthroplasty subgroups were not evaluated separately because of the inadequate number of patients in each group. The patient who undergone unicondylar arthroplasty number was not enough for the statistical analysis.

**Table 4**

Bleeding amount of the patients.

	Intraoperative bleeding (cc)	Postoperative bleeding (drainage tube) (cc)
Group-1	114 (90–150)	400.4 (140–650)
Group-2 (cryo-therapy)	116 (80–180)	365 (150–900)
	$P > 0.05$	$P > 0.05$

## 3. Discussion

After a serious orthopedic surgery like arthroplasty, the control of the edema and the pain are of vital importance [8,9]. The cooling effect of the *cryotherapy* has been used in fighting the pain and edema for a long time [2]. Although there are studies showing that in acute sports injuries it is extremely effective in decreasing the pain and in decreasing the use of analgesics either by slowing down the conduction in the nerve endings or by slowing down the blood flow [4,8], there is no clear consensus on its efficiency after major surgeries like knee arthroplasty.

Levy et al. and Webb et al. conducted a study and reported that it was influential in the pain control and the amount of the bleeding [9,10]; in the study of Morsi, it was reported that the *cold application* was not effective in pain and bleeding control [7,11]. Especially after the arthroplasty surgeries in the elderly population, it is twice important that the use of analgesics is decreased in order to prevent the damage to the kidney functions. In our study, the visual pain scores of the patients who received Cryo/Cuff application were lower at a statistically significant level. Cold therapy slows down the nerve conduction, also slows down the blood flow and makes the pain smaller and depending on this, patients have less usage of analgesics.

The cryo/cuff application is crucial in that it ensures that the knee ROM movements start in the early postoperative period. It also decreases the use of analgesics. There are studies reporting that the Cryo/Cuff therapy affects the knee movement gap in a positive way in the early postoperative period [8,9,11]. Similarly, in our study, the knee function scores (KSS) were statistically higher both in the early postoperative period and in the follow-up period (postoperative 5th day) in the group which received the Cryo/Cuff therapy, additionally KSS pain sub-scores were statistically higher in the group that received the Cryo/Cuff therapy and this is paramount for the postoperative physical treatment adaptation and decreased need for analgesics (Table 3).

We did not observe a significant difference ( $p > 0.05$ ) when we evaluated the effect of the cryotherapy on the amount of bleeding during the surgery, which was not reported previously in literature. We observed that the amounts of bleeding were similar to the values reported in previous studies.

Although cryotherapy can be applied easily and safely by the caregiver of the patient or by a nurse without skin irritations and wound healing problems [11,12], it has one single disadvantage that

cryotherapy is not a routinely used procedure after total knee arthroplasty. If the surgeon wants to use cryotherapy treatment, this brings extra costs to the hospital because of the single-use components of the cryotherapy.

The prospective design, randomization of patients, and the evaluation of bleeding amount for the first time in literature are among the strengths of this study.

The most important limitation of our study is the small number of the patient groups. The nonhomogeneous ratio of the unicompartmental prosthesis and total knee prosthesis is another limitation. In the future, prospective randomized studies conducted on homogeneous and large patients are warranted.

#### 4. Conclusion

After knee arthroplasty, the preoperative and postoperative use of cryotherapy is effective in terms of the pain control and functional knee scores; without significant changes in intraoperative and postoperative bleeding and the hemoglobin values.

#### Conflict of interest

All authors declared that they had no conflict of interest.

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