ATATÜRK ÜNİVERSİTESİ YAYINLARI
ATATURK UNIVERSITY PUBLICATIONS

Systematic Review/Meta-Analysis
Sistemik Derleme/MetaAnaliz

DOI: 10.61745/ jsmsau.1422161

The Effect of Local Cold Application after Total Knee Arthroplasty: a Systematic Review

Total Diz Artroplastisi Sonrası Lokal Soğuk Uygulamanın Etkisi: Sistematik İnceleme

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ABSTRACT

Objective: In the present systematic review, it was aimed to review the studies systematically that researched the effect of local cold application after total knee arthroplasty.
Methods: The open-access full-text articles published between 2002-2023 in Turkish and English languages with prospective, randomized controlled experimental and semi-experimental control group design that researched the effects of local cold application on the operation site after total knee arthroplasty were examined to carry out a systematic review. The advanced screening method was applied using Turkish and English equivalents of the keywords ''total knee arthroplasty and cold application'', ''total knee arthroplasty and cold therapy'', ''total knee arthroplasty and cold compress therapy'', ''the effect of cold therapy in total knee arthroplasty'' separately and together in the Pubmed, Google Scholar, ScienceDirect, Cochrane, Turkish Medline, Scopus and Cinahl databases. Totally 2,233 articles were reached. 7 studies which met the sample criteria were included in the systematic review.
Results: In the sample groups of the studies included in the systematic review, it was determined that cold application significantly reduced pain and swelling (P<.05), analgesic drug use (P<.05), bleeding and haemoglobin loss (P<.05), and contributed to faster and more effective ROM exercises in patients with total knee arthroplasty and local cold application.
Conclusion: It was observed that application of cold methods particularly in the early period had a positive effect on pain, swelling, haemorrhage and haemoglobin loss and amount of analgesic use underwent total knee arthroplasty

ÖZ

Amaç: Bu sistematik incelemede, total diz artroplastisi sonrası lokal soğuk uygulamanın etkisini araştıran çalışmaları sistematik olarak incelenmesi amaçlanmıştır.
Yöntemler: Sistematik inceleme amacıyla total diz artroplastisi sonrası ameliyat bölgesine lokal soğuk uygulama yapılarak etkilerinin araştırıldığı, 2002-2023 yılları arasında yayınlanan, yayın dili Türkçe ve İngilizce olan, prospective, randomize kontrollü deneysel ve yarı-deneysel kontrol gruplu tasarım tipinde olan ve tam metin erişimine açık makaleler incelendi. Pubmed, Google Scholar, ScienceDirect, Cochrane, Türk Medline, Scopus ve Cınahl veri tabanlarında ''total diz artroplastisi ve soğuk uygulama'', ''total diz artroplastisi ve soğuk terapi'', ''total diz artroplastisi ve soğuk kompress terapi'', ''total diz artroplastisinde soğuk terapinin etkisi'' anahtar kelimeleri tek tek ve birlikte kullanılarak gelişmiş tarama yöntemi uygulandı. Toplam 2.233 makaleye ulaşıldı. Bu makalelerden örneklem ölçütlerini sağlayan 7 çalışma inceleme kapsamına alınmıştır.
Bulgular: Sistematik inceleme kapsamına alınmış çalışmaların örneklem grubunu total diz artroplastisi geçirmiş ve lokal soğuk uygulama yapılan hastalarda; ağrı ve şişkinliği azalttığı (P<.05), kanama ve hemoglobin kaybını azalttığı (P<.05), ROM hareketlerinin daha hızlı ve etkin yapılmasına katkı sağladığı (P<.05) belirlenmiştir.
Sonuç: Soğuk uygulama yöntemlerinin total diz artroplastisi geçiren hastalara özellikle erken dönemde uygulanmasının hastaların ağrı, şişlik, kanama ve hemoglobin kaybı, analjezik kullanım miktarı, erken mobilize olmaları, taburculuk süresi, hasta memnuniyet oranı üzerinde pozitif bir etkisinin olduğu görülmektedir.

Anahtar Kelimeler: Total diz artroplastisi, cryotherapy, soğuk terapi, lokal soğuk uygulama.

Geliş Tarihi/Received 18.01.2024
Kabul Tarihi/Accepted 15.04.2024
Yayın Tarihi/Publication Date 25.08.2024

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Cite this article: Polat O, Yava A, Koyuncu A. The Effect of Local Cold Application After Total Knee Arthroplasty: A Systematic Review. *Atatürk Univ Fac Med J Surg Med Sci*. 2024;3(2): 38-47

INTRODUCTION

Total knee arthroplasty (TKA) is a surgical treatment technique applied in serious joint injuries of the knee. Its general indications include osteoarthritis, rheumatoid arthritis, inflammatory polyarthropathies, instability and deformity causing severe pain associated with advanced joint disease unresponsive to conservative treatment. The conditions such as recently suffered septic arthritis and paralysis of the muscles surrounding the related joint and neuropathic joint disease, advanced level osteoporosis and very serious ligament lesion around the joint are evaluated as its contraindications. Urinary retention and urinary infection, delayed wound healing, nerve injuries (particularly peroneal nerve), stress fractures (patella, femur and tibia), instability, subluxation and dislocation of prosthesis, and infection are the potentially developing complications. There is no certain age limit for inflammatory joint diseases such as rheumatoid arthritis, however, age, occupation, daily activity level and most importantly body weight of the patient should be absolutely taken into consideration in planning knee prosthesis for degenerative osteoarthritis. Total knee arthroplasty is performed more frequently between 65-84 years of age and in women. It is usually not preferred in the patients who are below 60 and obese. More simple interventions such as osteotomy should be primarily preferred in the younger patients. The objectives of total knee arthroplasty can be summarized as relief of severe pain, repair of the deformities, retrieval of the functions and prevention or removal of the painful secondary effects. The life quality of the patient is increased by decreasing the pain using this technique. [1-4]

Joint stiffness, limited motion in the knee function, pain, oedema (swelling), haemorrhage and infection are the most common complications after total knee arthroplasty. As well as pharmacological methods such as administration of antibiotics and analgesics, non-pharmacological methods such as cold application, kinesiological banding, elevation, deep friction massage, lower limb exercises, quadriceps femoris isometric exercises and straight leg raising are also used to cope with these complications. [5]

At the present time, cold applications are used as the adjuvant treatment methods in many fields such as particularly orthopaedics and traumatology, rheumatology and neurology. [6] Local cold application was found effective on pain management and functional knee scores in the postoperative period after total knee arthroplasty operations. [7-8]

Local cold application is a low-cost and simple treatment which reduces temperature level of the tissue using ice or cooled water bags on the skin surrounding the injury. [9-10] The kinds of local cold application are cold pack, ice massage, gel packs, immersion packs, cold towel, intermittent cooling equipments and sprays. Local cold application penetrates soft tissues, decreases internal temperature of the joint and consequently decelerates the transmission of the nerve stimuli when applied on a joint. [11-12] These changes reduce both transmission of the harmful signals and also inflammatory response and thereby perceived pain, swelling and blood flow decrease. [13]

The aim of the present systematic review was to systematically examine the effect of local cold application after total knee arthroplasty and contribute to the literature by increasing the awareness on this subject. In this study, the question of "What is the effect of local cold application after total knee arthroplasty?" was explored in accordance with the aim of the study.

METHODS

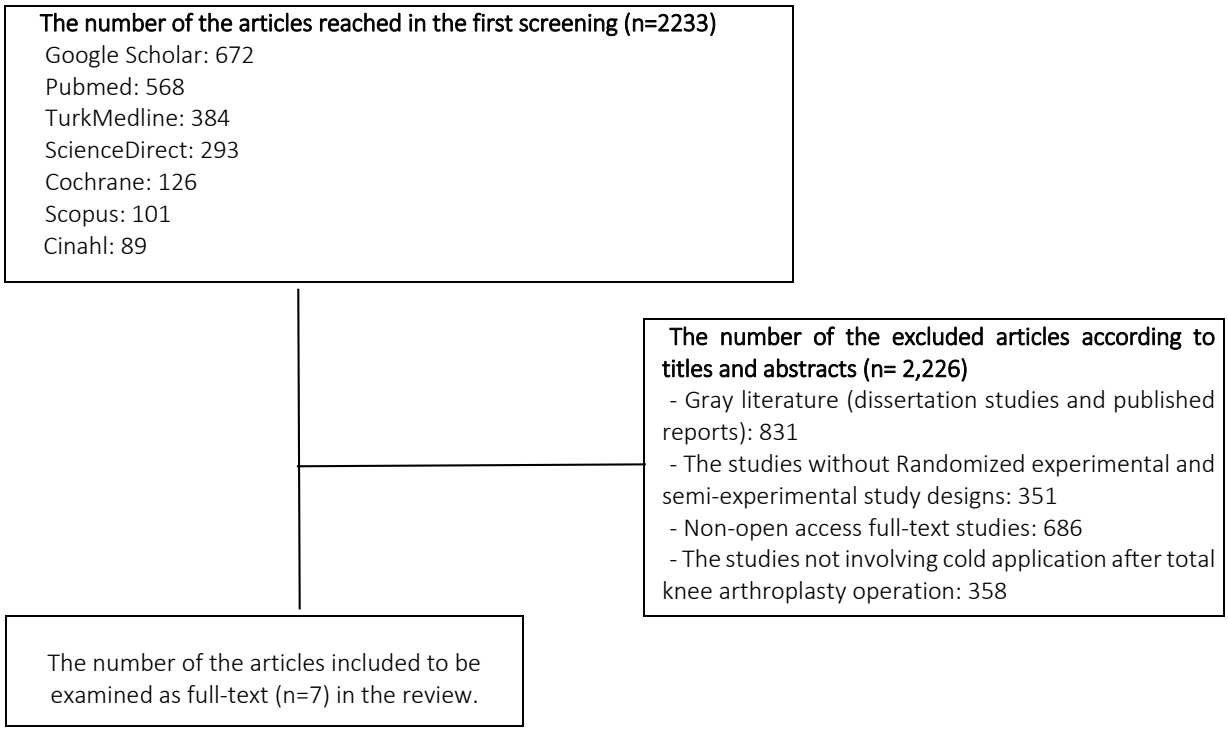
Screening process: Literature screening was carried out using the keywords ‘‘total knee arthroplasty and cold application’’, ‘‘total knee arthroplasty and cold therapy’’, ‘‘total knee arthroplasty and cold compress therapy”, “The effect of cold therapy after total knee arthroplasty’’ and Turkish equivalents of these words. The last screening was performed on 23th June 2023. The research articles related with the subject published between 2002-2023 were involved in the review. As a result of the screening, 672, 568, 384, 293, 126, 101 and 89 studies were reached in the databases of Google Scholar, Pubmed, Turkish Medline, Science Direct, Cochrane, Scopus and Cinahl, respectively. Totally 2,233 studies were reached. The titles and abstracts of these studies were examined by the researchers, evaluated with respect to inclusion criteria of the research and consequently 7 studies were included in the systematic review. In this review, PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) checklist tool was used for literature screening, as well as summarizing and reporting the obtained results. (Figure 1) All researchers contributed equally at all stages of this study.

Inclusion criteria: The open-access full-text articles published between 2002-2023 in Turkish and English languages with prospective, randomized controlled experimental and semi-experimental control group designs were included in the systematic review. The present review involved the studies that were published in a national/international peer-review journal and constituted by the patients who received cold-application in the

postoperative period after total knee arthroplasty. Seven studies that met inclusion criteria were enrolled in the review.

Exclusion criteria: As a result of the screening, reports and dissertation studies defined as gray literature, studies without randomized experimental and semi-experimental study designs, non-open access full-text studies and the studies not involving local cold application after total knee arthroplasty operation were excluded from the systematic review.

Figure 1. The flow diagram of literature screening and study selection (PRISMA)- 2009



RESULTS

Li et al. have evaluated pain level, analgesic consumption, haemoglobin values, haemorrhage amount, swelling on the knee, sleep quality and patient satisfaction in their study conducted on totally 389 patients consisting of Control group (n: 192) with a mean age of 61.8±5.8 years who underwent total knee arthroplasty operation between May 2012 and May 2014 and Intervention group (n:197) with a mean age of 60.7±6.5 years. It was encountered that both groups were administered diclofenac sodium (50 mg) parecoxib (40 mg) and tramadol as medication. The Intervention group was additionally administered cold irrigation solution containing 0.5% epinephrine for 30-40 minutes with intervals of 4 hours during the postoperative 24 hours. The Control and Intervention groups were assessed with VAS pain scores in the first 4 hours (*P*= .0016) and at the end of the 24 hours (*P*=.0004). Analgesic consumption: 0-12th hours (*P*=.0033), 12th-24th hours (*P*=.0021). Haemoglobin level: 30.2 g/dl in the Control Group and 26.1 g/dl in the Intervention Group. Haemorrhage amount: 155.8 ml in the Control Group and 130.6 ml in the Intervention group. Swelling on the operation site was assessed as 2.3 cm in the Control group and 1.9 cm in the Intervention group (*P*=.0007). The mean sleep quality was 45.2% in the Control group and 49.6% in the Intervention group (*P*=.01). The patient satisfaction rate was assessed to be 74.8% in the Control group and 76.8% in the Intervention group (*P*=.03). It was reported that the Intervention group had significantly lower pain score compared with the Control group, analgesic consumption decreased, sleep quality increased, haemoglobin and blood loss were lower, swelling on the operation site was significantly lesser and patient satisfaction level was higher than the Control group, therefore, use of cold irrigation

solution containing 0.5% epinephrine was recommended for also its low-cost. [14]

Totally 60 patients, consisting of 27 patients who underwent unicondylar arthroplasty and total knee arthroplasty between 2013-2014 in the Control group and 33 patients in the Intervention group, were evaluated in the study of Kuyucu et al. The mean ages of the Control and Intervention groups were determined as 67.2 (57-78) and 68.4 (53-78) years, respectively. Visual Analog Scale (VAS) scores for pain conditions, Knee Society Scores (KSS) for knee function test, haemorrhage amount and haemoglobin levels were assessed in their study. It was reported that both groups received routine therapy while Intervention group additionally received cold application preoperatively for 2 hours and postoperatively for 1 hour at every 6 hours and 2 hours every day during the following 4 days. VAS Pain score of the Control group was 4.5-3.3 between 1st-5th days whereas VAS Pain score ranged between 2.1-3.0 in the Intervention group (*P*<.05 for all days). The mean knee society function score (KSS): Control group: 80.3; Intervention group: 90.5 (*P*<.05). The mean haemoglobin levels: Control Group: 12.8-9.0 mmol/d, Intervention group: 12,5-9.1 mmol/dl (*P* >.05 for all days). Mean haemorrhage amount: Control Group: Intraoperative haemorrhage: 114 (90-150). Intervention Group: 116 (80-180) (*P*>.05). Postoperative haemorrhage: Control Group: 400.4 cc (140-650). Intervention Group: 365 cc (150-900) (*P*>.05 for all days). It was observed that there was a significant difference between two groups in terms of pain assessment and consequently in terms of analgesic use. It was reported based on the knee society function score that Intervention group had higher range of motion whereas no significant difference was found between the groups regarding haemorrhage amount and haemoglobin values. [15]

Desteli et al. have evaluated totally 87 patients constituted by 45 patients who underwent total knee arthroplasty operation in the Control group and 42 patients in the Intervention group. The Control group included 22 males and 23 females with a mean age of 65.36 ±6.9 years while Intervention group comprised 22 males and 20 females with a mean age of 65.14±4.06 years. Verbal rating pain scores, haemoglobin levels, haemorrhage amounts, blood transfusion amounts and hospital stay durations of the patients were detected. It was determined that all patients were applied elastic bandage for compression, 3 ml diclofenac sodium as the identical analgesic drug, 100 mg diclofenac tablets (Diclomec®, Abdi İbrahim, İstanbul, Turkey) twice daily and tramadol hydrochloride (contramal, Mefar İlaç, İstanbul, Turkey) once at the postoperative 6th hour. It was stated that Control group was administered standard cold application using ice packs with 15-minute periods for 8 times and intervals of 45 minutes on the operation day and postoperative 2nd day while operated knees of the Intervention group were applied c-pad (cryoceutical) preoperatively for 90 minutes until the operation and postoperatively for 6 hours on the operation day beginning just after the operation and for 2 hours in the following postoperative 2 days. The mean VRPS score of the Control group was 6.1 whereas VRPS score of the Intervention group was 6.6 (*P*>.05). The haemoglobin levels were assessed on the preoperative and postoperative 48th hours. The preoperative haemoglobin levels of the Control and Intervention groups were 13.12±1.3 g/dl and 12.5-9.1 g/d, respectively (*P*<.001). The postoperative haemoglobin levels of the Control and Intervention groups were 9.91±1.25 g/dl and 11.22±1.14 g/dl, respectively (*P*<.001). Postoperatively 24 hours later, the mean haemorrhage amounts of the Control and Intervention groups were 319.78±60.66 cc and 210.24±52.43 cc, respectively (*P*<.001). Need for blood transfusion (Hb≥8 g/dl) was present in 37 and 40 patients in the Control and Intervention groups, respectively. The mean hospital stay durations were 7.2±1.5 and 7.4±1.2 days, respectively (*P*=.756). It was reported that significant differences were discovered between the groups in terms of postoperative haemoglobin level and blood drainage amounts, however, no significant difference was present between two groups in terms of mean verbal rating pain scores, blood transfusion amounts and hospital stay durations. [16]

Bech et al. have carried out their study on totally 71 patients, 34 patients in the Control group and 37 patients in the Intervention group, between February 2009 and May 2012 and they evaluated the effects of cold ice pack and intermittent cooling device on the pain level, knee function score, rates of nausea and vomiting (between the postoperative 24th-48th hours), opioid use in terms of mg, change in haemoglobin levels in terms of g/l (between the postoperative 24th-48th hours), hospital stay duration and patient satisfaction rate in their study. The control group was applied cold ice pack intermittently for 48 hours during the general care of the patients and upon request whereas the Intervention group received cold application once for every 4 hours for postoperative 48 hours using intermittent cooling device. It was stated that both groups were administered fentanyl, oxycodone and morphine as analgesic drugs. The results of their study were detected as the following: Pain score (NRPS) Control group: 3.6; Intervention group: 3.8 (*P*=.67). Passive Range of Motion (PROM) test (postoperatively 48 hours later) Control group: 59.8; Intervention group: 54.0 (*P*=.14). Nausea and vomiting: Control group: 15.6%; Intervention group: 34.3%

(between the postoperative 24th-48th hours) (*P*=.08). Opioid use (between the postoperative 24th-48th hours), Control group: 42.3 mg; Intervention group: 49.9 mg (*P*=.33). The change in haemoglobin levels in terms of g/L (between the postoperative 24th-48th hours): Control group: -8.8; Intervention group: -7.7 (*P*=.68). The duration of hospital stay: Control group: 4.8 days, Intervention group: 5.8 days. Patient satisfaction: Control group: 63%, Intervention group: 96.9%. It was reported as the conclusion of this study that there was no significant difference between the Control group (applied cold ice pack intermittently for 48 hours) and the Intervention group (applied intermittent cooling device for 48 hours) in terms of pain score, passive ROM exercises, opioid use, haemoglobin levels, nausea-vomiting and duration of hospital stay whereas the Intervention group had significantly higher patient satisfaction. [17]

The study of Su et al. included totally 187 patients composed of Control group (n:84) patients who underwent total knee arthroplasty and were aging between 18-85 years and Intervention group (n:103) patients. It was found that assessments for pain level, Range of Motion (ROM) test, 6-minute walk test, assessments for the swelling rate around the knee and amount of analgesic drug use were performed in the postoperative 2nd-week and 6th-week evaluations. The same therapy protocol was implemented in the Control and Intervention groups. In addition, ice bag was applied in the Control group whereas the Intervention group received intermittent cooling air around the knee using cryopneumatic device. The postoperative 2nd-week evaluation revealed that the mean amount of morphine use was 680 mg ranging between 20-3225 mg in the Control group whereas the mean amount of morphine was 509 mg ranging between 15-1640 mg in the Intervention group (*P*< .05). Vas pain score (*P*=0) and swelling rate around the knee (*P*=0) were obtained. It was reported at the end of the postoperative 6th week that mean number of steps in the 6-minute walk test were 7.9 and 29.4 in the Control and Intervention groups, respectively (*P*=,13). It was denoted that there was no significant difference between the Control and Intervention groups in terms of VAS pain score during the postoperative 2nd week and besides two groups showed similar results in the 6-minute walk test, ROM test and assessment of swelling rate around the knee. It was reported that the Intervention group consumpted less amount of analgesic drug (morphine) and that there was a significant difference in favor of the Intervention group regarding only 6-minute walk test while no significant difference was encountered in terms of other parameters. [18]

In the study of Kullenberg et al. on 40 patients who underwent total knee arthroplasty in the Control group and 43 patients in the Intervention group; assessments of pain level (at the postoperative 1st and 3rd days, during the exercise), amount of analgesic drug use (drugs used at the postoperative 1st and 3rd days, during the exercise: tramadol, paracetamol), range of motion (ROM) test (at the postoperative 1st day, discharge and at the end of the 3rd week), decrease in the haemoglobin level and time to hospital discharge. The Intervention group was additionally administered cold compress once at 1 hour during 60 hours whereas control group received only routine therapy. The results of the study were presented as following: VAS pain score: Control group: 2.2 at the 1st day, 1.2 at the 3rd day, 2.3 during the exercise; Intervention group: 2.1 at the 1st day, 0.8 at the 3rd day, 3.4 during the exercise. Range of motion (ROM) test: Control group: 51.4° at the first day, 62.9° at discharge, 87.6° at the end of the 3rd week; Intervention group: 50.4° at the first day, 75.1° at discharge, 98.9° at the end of the 3rd week (*P*=.0045). Haemoglobin value: Control group: 109.5 mmol/L. Intervention group: 120.2 mmol/L (*P*=.042). The amount of analgesic use: Control group: 0.43 mg (mg morphine/kg per person) Intervention group: 0.37 mg (mg morphine/kg per person). Time to hospital discharge: Control group: 6.2; Intervention group: 4.8 (*P*=.002). This study demonstrated that cold compression therapy created a difference on pain level and amount of drug consumption, however this difference was not significant, whereas, cold compress therapy provided benefits on the parameters haemoglobin level and Range of Motion (ROM), thereby it can shorten the duration of hospital stay. [19]

Morsi. has evaluated totally 60 patients, 30 patients who underwent total knee arthroplasty in the Control group and 30 patients in the Intervention group. It was noted that continuous cooling air was postoperatively applied on the incision site in the Intervention group adjusted to keep the skin temperature at 7°C in the first 2 hours and subsequently 12°C whereas the Control group received routine treatment protocol. It was stated that assessments of pain level using Visual Analog Scales (VAS) (measured at the postoperative 1st and 2nd hours and once every 8 hours during the next 6 days), knee functions with range of motion (ROM) test (assessed during the first 6 weeks), haemorrhage amount (using hemovac drain during the first 48 hours), decrease in haemoglobin level, time to wound healing, amount of analgesic drug use (hydrocodone and acetaminophen for 6 days) were performed. Pain level: 6.3 in the Control group, 4.2 in the Intervention group (*P*< .001). Range of Motion (ROM) test: Control group: 54°. Intervention group: 68° at the first week (*P*< .01). There was

a difference between the 2nd-6th weeks, although not significantly. Haemorrhage amount (during 48 hours): Control group: 810 ml; Intervention group: 503 ml (*P*< .001). Mean haemoglobin loss: Control group: 4.6 mg; Intervention group: 2.9 mg (*P*<.001). No significant difference was found in terms of time to wound healing. The mean amounts of analgesic use in the groups were reported such as following: Control group: Administered 2.8 mg (1400 mg) drug, Intervention group: Administered 1.9 mg (950 mg) drug (*P*<.001). Compared with the Control group, it was stated that the Intervention group which received continuous cooling air therapy had lower pain level, higher range of motion, lower amount of haemorrhage and less reduction in haemoglobin level and significantly lower analgesic use whereas no significant difference in terms of time to wound healing. [20]

DISCUSSION

Serious complications such as pain condition, blood loss, changes in haemoglobin levels, oedema (swelling), restricted ROM, excessive analgesic consumption and consequent complications occur in the patients after total knee arthroplasty operation. The effect of cold application as a non-pharmacological treatment method as well as pharmacological therapy in the patients who experienced these complications was evaluated in the 7 literature studies enrolled in our review.

Pain is usually severe in the postoperative early period after total knee arthroplasty operation and it prevents rehabilitation. Mobilization requires pain control, however, side effects associated with narcotics (nausea, vomiting, sedation, itching, hypotension and respiratory distress) may limit the activity and they increase the morbidity, impair sleep quality, prolong hospital stay duration and reduces patient satisfaction. It is very important to achieve pain control while minimizing the side effects. [21-22] Thienpont et al., 2007. have reported in their study on 116 patients with TKP that cold application using cold packs is effective in reducing the postoperative swelling. [23] Levy and Marmar, 1993. have evaluated the effect of local cold application on improving in the patients who underwent total knee arthroplasty and reported that postoperative application of cold compress therapy decreased blood loss, swelling and pain and that increased range of motion in a shorter duration. [24] It has been encountered in the studies enrolled in the present systematic review that use of local cold application methods accompanied with pharmacological methods is an effective method in reducing pain and swelling and that it decreases analgesic consumption. Adie et al., 2012. have included that cold therapy showed a non-significant beneficial effect on blood loss, pain and ROM. [9] It has been noted also in the studies examined in our review that local cold application has a significantly positive effect on blood loss and ROM exercises. In addition, regarding haemoglobin levels, although there are some studies which denoted that no significant difference was found between the groups, the literature studies included in our review have reported significant differences between the groups.

In NRS-2002 screening test, nutritional risk is considered for scores ≥3. [10] In a previous study, the malnutrition risk among hospitalized oncology patients was reported as 33.9% upon admission. [11] However, only 1.9% of our patients were ≥3 score in NRS-2002 at our service. Compared with the literature, the malnutrition risk rate was low in our inpatient clinic. Also, the percentage of overweight patients was higher than our underweight patients. One of the reasons for the low malnutrition rate may be the nature of cross-sectional retrospective study in which we do not know previous treatment of malnutrition or any other interventions. Also, the majority of our patient population is younger than 65 years old, which might have an effect on the low NRS-2002 score. Another possible reason for the low malnutrition rate in our series could be hospitalization due to transportation problems to the RT unit.

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To our knowledge, synergistic effect between RT and chemotherapy increased acute hospital admissions from 20% in RT only group to approximately 60% in concurrently treated group. [9] This might have an effect on nutritional status of our hospitalized patients. However, we are unable to provide our patients' concurrent chemotherapy information.

Table 1. Overview of the literature

Author and publishment year	Research Title	Sampling Features	Pain	Swelling	Knee Society Function Score (KSS)	Haemorrhage amount	Haemoglobin values	Analgesic-Opioid use
Li et al.[14]	Effects of Cold Irrigation on Early Results after Total Knee Arthroplasty	Randomized, Double-blind, Controlled Study Control (n:192) Intervention (n:197)	VAS pain score within the first 4 hours ***P*=.00.** At the end of 24 hours ***P*=.00.**	Swelling at the operation site at the end of 48th hour Control: 2.3 cm. Therapy: 1.9 cm ***P* = .0007**		Postoperative 24 hours later Control: 155.8 ml Intervention: 130.6 ml ***P* <.001**	Control: 30.2 g/dl Intervention: 26.1 g/dl ***P* <.001**	Analgesic use: 0-12 hours ***P* = .0033**. 12-24 hours ***P* = .0021**.
Kuyucu et al.[15]	Is cold therapy really effective after knee arthroplasty?	Randomized Controlled Study Control group (n:33) Intervention group (n:27)	VAS Pain Score Control: 3.3-4.5 Intervention: 2.1-3.0 ***P* < .05**		Control: 80.3% Intervention: 90.5% ***P* <.05**	Control: 12.8-9.0 mmol/dl Intervention: 12.5-9.1 mmol/dl (***P* >.05** for all days)	Postoperative haemorrhage Control: 400.4 (140-650) cc Intervention: 365 (150-900) cc (***P* >.05** for all days)	
Desteli et al. [16]	Effect of both preoperative and postoperative cryoceutical treatment on haemostasis and postoperative pain following total knee arthroplasty	Randomized Controlled Study Control group (n:45) Intervention group (n:42)	VRPS Pain Score Control: 6.1 Intervention: 6.6. ***P* <.05**			Haemorrhage amount postoperative 24 hours later Control: 319.78± 60.66 cc Intervention: 210.24±52.43 cc ***P* <.001**	Postoperative haemoglobin Control: 9.91±1.25 g/dl Intervention: 11.22-1.14 g/dl. ***P* < .001**	
Bech et al. [17]	Device or Ice: The Effect of Consistent Cooling Using a Device Compared with Intermittent Cooling Using an Ice Bag after Total Knee Arthroplasty	Randomized Controlled Study Control group (n:34) Intervention Group (n:37)	NRP Pain score Control: 3.6 Intervention: 3.8 ***P* =.67.**		PROM test (48 hours after surgery) Control: 59.8 Intervention: 54.0 ***P* =.14**		Postoperative 24-48 hours Control: -8.8 Intervention: -7.7 ***P* =.68**	

Su et al. [18]	A prospective, multicentre, Randomized trial to evaluate the efficacy of a cryopneumatic device on total knee arthroplasty recovery	Prospective, multicentre, Randomized Controlled Study Control group (n: 84) Intervention group (n:103)	VAS pain score ***P* = 0**	Swelling rate around the knee: ***P* = 0**				Morphine use in control group: Ranging Between 20-3225 mg Mean: 680 mg morphine use in the intervention group: Ranging between 15-1640 mg. Mean: 509. ***P* <.05**
Kullenberg et al. [19]	Postoperative Cryotherapy After Total Knee Arthroplasty	Prospective, Randomized Controlled Study (n:83) Control group: (n:40) Intervention Group: (n:43)	VAS pain score Control group: 3.4 Intervention group: 2.3 ***P* <.05**		ROM: Control: 1st day: 51.4° At discharge: 62.9°. At the end of 3rd week: 87.6° Intervention group: 1st day: 504°. At discharge: 75.1°. At the end of 3rd week: 98.9° ***P* = .0045**		Control: 109.5 mmol/L Intervention: 120.2 mmol/L ***P* =.042**	Analgesic use Control group: 0.43 (mg morphine/kg per person) Intervention group: 0.37 (mg morphine/kg). ***P* < .001**
Morsi [20]	Continuous-flow cold therapy after total knee arthroplasty	Prospective, Randomized Controlled Study Control (n: 30) Intervention: (n:30)	VAS pain score Control group: 6.3 Intervention group: 4.2 ***P* < .001.**		Mean Range of Motion (ROM) at 1st week: Control group: 54° Intervention group: 68° ***P* <.01**	Mean haemorrhage amount (for 48 hours) Control: 810 ml. Intervention: 503 ml ***P* < .001.**	Mean haemoglobin loss Control: 4.6 mg Intervention: 2.9mg ***P* < .001**	Analgesic use: Control group: Used 2.8 (1400 mg) tablets, Intervention group: Used 1.9 (950 mg) tablets ***P* < .001**

This study has limitations inherent to any retrospective study as missing information about follow up. In previous studies, both BMI and weight loss independently predicted the overall survival of cancer patient. [4] However, we were unable to report that follow up information of our patients' weight loss, nutritional intervention, second NRS-2002 score results. Also, we do not have specified data about nutritional interventions, chronic diseases and concurrent chemotherapy. These might have an effect on low malnutrition screening ratio of our inpatients.

As a summary, we aimed to look at nutritional status of patients in radiation oncology inpatient unit from a cross sectional view in this study. When we screened the risk of malnutrition of inpatients in the radiotherapy inpatient service using the NRS 2002 test, we did not detect an increased risk in our study. Further research is required in order to optimize nutritional intervention and follow up data for evaluating the nutritional status of patients in radiation oncology inpatient service.

Peer-review: Externally peer-reviewed.
Author Contributions: Concept - **OP, AY, AK**; Design- **OP, AY, AK**; Supervision- **AY, AK**; Resources- **OP, AY, AK**; Data Collection and/or Processing- **OP, AY**; Analysis and/or Interpretation- **OP, AY, AK**; Literature Search- **OP**; Writing Manuscript- **OP, AY, AK**; Critical Review- **OP, AY, AK**
Conflict of Interest: The authors have no conflicts of interest to declare.
Financial Disclosure: The authors declared that this study has received no financial support.

Hakem Değerlendirmesi: Dış bağımsız.
Yazar Katkıları: Fikir- **OP, AY, AK**, Tasarım- **OP, AY, AK**, Denetleme- **AY, AK**, Kaynaklar- **OP, AY, AK**, Veri Toplanması ve/veya İşlemesi- **OP, AY**, Analiz ve/ veya Yorum- **OP, AY, AK**, Literatür Taraması- **OP**, Yazıyı Yazan- **OP, AY, AK**, Eleştirel İnceleme- **OP, AY, AK.**
Çıkar Çatışması: Yazarlar, çıkar çatışması olmadığını beyan etmiştir.
Finansal Destek: Yazarlar, bu çalışma için finansal destek almadığını beyan etmiştir.

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