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Cryotherapy compared with Robert Jones bandage after total knee replacement: A prospective randomized trial

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Abstract Sixty patients undergoing total knee replacement were randomized to receive either a cold compression dressing (Cryo/Cuff, Aircast, UK) or a modified Robert Jones bandage immediately after surgery. The cold compression dressing was used for a minimum of 6 h per day throughout the hospital stay, and the modified Robert Jones bandage remained in place for 48 h from the time of operation. The 2 groups of patients were compared during their hospital stay for blood loss, range of movement, pain scores and need for analgesia. No difference was found between the 2 groups except for less blood loss in the surgical drains in the cold compression group ($P<0.05$). Postoperative complications were seen in both groups, but no complication was associated with either the cold compression dressing or the modified Robert Jones bandage.

Résumé Etude randomisée de 60 patients qui, immédiatement après une arthroplastie totale du genou ont eu soit un pansement compressif froid de type "Cryocuff" soit un pansement compressif de type Robert Jones. Le pansement froid a été utilisé 6 heures par jour pendant la durée de l'hospitalisation tandis que le pansement compressif de type Robert Jones a été laissé en place pendant 48 heures après l'opération. Aucune différence statistiquement significative n'a pu être mise en évidence entre les deux groupes, à l'exception des pertes sanguines dans le drainage, moins importantes dans le premier groupe de patients. Nous avons eu des complications post opératoires dans les deux groupes mais aucune corrélation n'a pu être établie entre ces complications et le type de bandage appliqué.

Introduction

The use of compression dressings and cold therapy is widespread and well recognized following soft tissue injuries and operative procedures. Robert Jones [8] was an advocate of compression dressings and the use of the Robert Jones bandage [2] is still seen in both accident and emergency and hospital inpatient wards alike.

Cold therapy has also been found to be beneficial after injury or operation by slowing pain signal transmission [1], local affects on tissue metabolism via decreasing enzyme function, and local vasoconstriction [3].

The use of cold compression dressings after total knee replacement has previously been described with variable results. Healy et al. [4] found no difference concerning blood loss, range of movement and pain relief in 2 groups of patients, one group using cold compression dressing and the other using simple ice packs. Both Levy and Marmar [7] and Webb et al. [9] have reported less blood loss and better pain relief in patients treated with cold compression dressings (Cryo/Cuff, Aircast, UK) in patients undergoing total knee replacement compared to a group of control patients. In this study we compared the use of a cold compression dressing with a modified Robert Jones bandage (3 layers of Velband and crepe) in 2 groups of patients after total knee replacement. The Robert Jones bandage was only used for a period of 48 h from the operation but the Cryo/Cuff was used throughout the hospital stay until discharge. We looked at a number of variables including blood loss, analgesia use, pain scores and range of movement during the period of hospital stay. We also looked at the length of stay in both patient groups and any complications after surgery were recorded.

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Patients and methods

A series of 60 patients were randomized after the study received ethics committee approval to receive either a cold compression dressing or a modified Robert Jones bandage after total knee replacement. Thirty patients were included in each group. All pa-

Table 1 Patient characteristics

	Cryo/Cuff	Robert Jones
Patients (<i>n</i>)	30	30
Age (years)	70	71
Osteoarthritis	25	27
Rheumatoid arthritis	5	3
Sex ratio M:F	11:19	14:16
Knee score	37	40
Function score	47	39
Mean blood loss (ml)	720	1200
Patients transfused	6	7

tients were pre-operatively assessed and knee and function scores [6] recorded by using the Knee Society clinical rating system. Both groups were well-matched for age, sex, diagnosis and knee and function scores (Table 1).

Pain scores using a visual analogue scale were recorded at rest prior to operation. A standardized anesthetic regimen was used and all patients were given patient-controlled analgesia (PCA) in the form of a morphine pump for the first 48 h. The amount of morphine used over this period was calculated in relation to the weight (kg) of the patient.

The patients in both groups underwent total knee replacement using the same surgical technique with the same prosthesis (Rota-glide knee: Corin). A tourniquet was used in all cases and this was deflated once the cold compression dressing or modified Robert Jones bandage was in place. One surgical drain was used and this remained in place for 48 h from the time of operation.

The cold compression dressing was placed over a single layer of crepe and Velband immediately after the procedure and the physiotherapists removed this subsequent layer once the patient was back on the ward. The Cryo/Cuff consists of an inflatable cuff placed around the knee and attached at the back with Velcro straps. The cuff is filled with ice-cold water via a tube attached to an ice bucket. The cuff thus provides compression and cold therapy, which can last up to 60 min.

The control group of patients received a modified Robert Jones bandage producing firm compression in the form of 3 layers of Velband and crepe, which remained in place for 48 h. Neither group received continuous passive motion and the postoperative physiotherapy regimen was the same.

Postoperatively the blood loss was recorded by the drainage (ml) in the suction tube. The amount of morphine received via the pump was recorded over the 48 h in which it was in place. The amount of oral analgesia in the form of co-dydramol was then also recorded up to the 10-day stage.

Pain scores were recorded on alternate days after a period of physiotherapy at the end of the afternoon. The range of movement of the operated knee was measured with a goniometer at 10 days post-operation. Patients in the cold compression group had use of the Cryo/Cuff for a minimum of 6 h during the day until discharge. Statistical significance was evaluated by the Student's *t*-test and the level of significance set up at $P < 0.05$.

Results

Blood loss

Blood loss was found to be less in the cold compression group with a mean value of 720 ml compared to 1200 ml in the modified Robert Jones group (Fig. 1). This was found to be statistically significant ($P < 0.05$). However, it did not result in any significant difference in transfusion requirements in the 2 groups (Table 1).

Fig. 1 Mean blood loss in the 2 patient groups (ml) **Fig. 2** Mean pre- and postoperative visual analog pain scores (0–100)

Range of movement

The range of movement in each group was found to be similar with a mean value of 5 to 82° in the cold compression group and 3 to 78° in the modified Robert Jones group. No statistically significant difference was found between the 2 groups ($P > 0.05$).

Pain scores

A similar pattern of pain scores (Fig. 2) was found in both groups with the level decreasing up to the 10-day mark ($P > 0.05$).

Analgesia

The weight (kg) of each patient was recorded pre-operatively and the amount of morphine used in the PCA calibrated according to the patient's weight. The mean value in the Cryo/Cuff group 0.65 mg kg⁻¹ 48 h⁻¹ compared to 0.6 mg kg⁻¹ 48 h⁻¹ with the modified Robert Jones bandage. The mean number of doses of co-dydramol was recorded up to the 10-day mark. A mean value of 44 doses was recorded in the cold compression group compared to 40 doses in the Robert Jones group ($P > 0.05$).

Length of hospital stay

The mean length of stay was slightly higher in the Cryo/Cuff group of patients (13 days) compared to the Robert Jones bandage group (11 days).

Complications

There were no recorded complications associated with either the use of the cold compression dressing or modified Robert Jones bandage, although 2 superficial infections occurred in each group.

Discussion

In our unit both cold compression dressings (Cryo/Cuff) and modified Robert Jones bandaging have been used after total knee replacement. In this study little difference was found between the 2 groups, apart from less blood loss in the suction drainage with the use of the cold compression dressing ($P<0.05$). This is consistent with the findings of Webb et al. [9] who compared a group of 40 patients undergoing total knee replacement and treated with a cold compression dressing (Cryo/Cuff) or simple wool and crepe. They recorded less blood loss and lower opiate requirements in the Cryo/Cuff group, both of which were found to be statistically significant. Levy and Marmar [7] also found a dramatic decrease in blood loss in their group of patients using a cold compression dressing after total knee replacement, with a significant reduction in morphine use.

Healy et al. [4] looked at the use of cold compression dressings compared to standard ice packs after total knee replacement. In his study all patients underwent continuous passive motion after operation, but no difference was found for blood loss, range of movement and morphine use postoperatively.

In the group of patients using the Cryo/Cuff after knee surgery we found the cold effect of the cuff only lasting up to 60 min, and the ice bucket required re-filling with ice every 3 h. This can be labor-intensive for

medical staff on the ward and negates the use of the cuff at night.

Complications associated with cryotherapy or the Robert Jones bandage were not recorded, but have previously been described after application of compressive dressings to the knee. Husni et al. [5] described a detrimental effect on venous blood flow and intramuscular blood circulation with the use of compression dressings. In this series no clinically obvious deep vein thrombosis or pulmonary embolus were recorded in either group during the hospital admission.

In conclusion we found the only significant difference was less blood loss in the cryotherapy group ($P<0.05$), but this did not result in a significant difference of transfusion requirements. Manufacturers of the Cryo/Cuff have recommended single patient use of the cuff, which we have not found practicable in the past due to the heavy cost implications. As of a result of this study we do not routinely use the Cryo/Cuff after total knee replacement, although it is a popular and well-tolerated form of cryotherapy for patients.

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