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Research article

Compressive cryotherapy is superior to cryotherapy alone in reducing pain after hip arthroscopy

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ABSTRACT

The early post-operative period after hip arthroscopy for femoroacetabular impingement is characterized by pain and swelling. Minimization of pain is of critical importance to the patient, but pain might also reduce patients' compliance to early physiotherapy, delay rehabilitation and hospital discharge. Avoiding early mobilization represents a risk factor for developing capsulolabral adhesions. Compressive cryotherapy (CC) has been shown to reduce pain after knee and hip replacement surgery. The aim of this study was to assess the effect of the inclusion of CC in the pain management and early discharge after hip arthroscopy. A prospective cohort of 20 patients who received CC and 20 retrospectively matched controls who received standard cryotherapy (SC) were compared. The CC was added to the standard post-operative analgesia and rehabilitation protocol. Using non-parametric tests, the percentage of patients discharged in post-operative day one, pain VAS scores and analgesia requirement were compared. The CC group reported significantly lower pain scores compared to SC; VAS 1 (0–3) and 2 (0–5) ($P = 0.0028$), respectively. A non-significant reduction in analgesic requirement 1.75 versus 2.8 doses per patient was found and 20/20 patients were discharged on post-operative day one versus 17/20 in the SC group ($P = 0.23$). Patients treated with CC after hip arthroscopy reported lower levels of pain during the early post-operative phase and were able to be discharged home sooner when compared with a matched control group receiving ice therapy alone. A trend towards lower opioid analgesia requirement was observed.

INTRODUCTION

Hip arthroscopy has become the most commonly performed method of surgical treatment for femoroacetabular impingement (FAI) due to its perceived advantages over open preservation surgery, and recent high-quality studies support its good results compared with conservative alternatives [1–5].

The early post-operative period is characterized by pain, swelling and inflammation, which, as well as potentially causing the patient significant distress, may cause delays in rehabilitation and hospital discharge. Pain might reduce patients compliance to early physiotherapy prescription which in hip arthroscopy has been shown to reduce the risk of capsulolabral adhesions [6].

Compressive cryotherapy (CC) for treating inflammation and pain in the early rehabilitation phase has been recently reported to have benefits over cryotherapy alone, both in arthroscopic knee and hip arthroplasty surgery [7, 8].

The influence of CC after hip arthroscopy has not been reported.

The aim of this study was to compare the effects of CC versus standard cryotherapy (SC) in the early post-operative period after hip arthroscopy for FAI. Specifically, the study aimed to evaluate the effect of CC on pain, analgesic requirement and early discharge.

Our hypothesis was that CC would improve post-operative pain relief and decrease the need for post-operative analgesia.

MATERIALS AND METHODS

This prospective cohort study included the first 20 patients (12 females and 8 males), average age 36 (range 15–65) years old in which CC (Game Ready®, CoolSystems®, San Diego, CA) was added as part of their routine in-patient post-operative management after hip arthroscopy. This CC device consists of a belt that securely wraps around the patient's waist and thigh. The belt has an inner chamber that fills with water pumped from an external pump that is located near the patient's bed. The pump creates a water flow from the water source that contains a mixture of water and ice, ensuring maintaining a stable 0°C temperature. The device is shown in Fig. 1.

This group was compared with 20 matched patients (11 female), aged 36 (18–62) years old treated during the preceding month, and who received the same protocol, except they received only ice application (SC) rather than CC.

Patients were matched for age, gender, BMI and traction times (Table I).

All patients signed informed consent prior to this study.

Patients were eligible for inclusion if they were ≥15 years old and were scheduled for hip arthroscopy. Candidates were excluded if they had any prior open surgery to the hip or their pain management included opioids during the 2 weeks prior to surgery.

Demographics, surgical procedures performed, pain (VAS) and upon request (PRN) analgesics administered during post-operative hospital stay and length of stay (LOS) were recorded.

Patients were asked whether they considered the CC system useful in their pain management (yes/no) and if it caused them any problems.

Complications regarding the use of the CC system were documented.

Control group (SC) protocol

Hip arthroscopies were performed in lateral decubitus under general anesthesia, without muscle relaxation and with no regional blocks.

Pain management premedication was not administered.

Arthroscopic portals were infiltrated with Bupivacaine/epinephrine (0.25%) (Marcaine®) at the beginning of the surgery.

Traction was kept to the minimum distraction to allow safe intraarticular placement and maneuver of the arthroscope (2.9 mm) and instruments. Traction times were recorded as the sum of intermittent traction in case it was temporarily released. There was no difference in the amount of traction applied for more complex central compartment procedures (microfractures, labral repairs) and that for simpler acetabular procedures, such as chondroplasty. Traction was released during femoral osteochondroplasty and capsular closure/plication.

Fig. 1. CC device, right hip.

Intraarticular Ropivacaine (20 mg/10 ml) plus Ketorolac (10 mgs), and Morphine (5 mgs) was administered before removing the arthroscope and closing the portals.

Upon request analgesia (PRN) included oxycodone (5 mg po) or tapentadol (50 mg po) per dose, and paracetamol. No patients required parenteral analgesics after surgery.

Physiotherapy was initiated on the same day as the procedure, allowing full weight bearing as tolerated with 2 crutches.

SC therapy (26 × 11 cm iced packs) was provided every 4 h.

CC group

The same protocol + CC was followed.

The CC belt was installed in the operation room and the system was activated upon arrival in the patient's room, and then continued until hospital discharge. It provided cycles of 30 min of cold therapy and 60 min sleep intervals

Table I. Baseline patient characteristics

	Compressive cryotherapy	*Control group*
Age (years), median (range)	36 (25–80)	36 (18–62)
Sex		
Male	8	9
Female	12	11
BMI (kg/m^2), median (range)	25.7 (19.6–41.1)	25.7 (17.7–29.7)
Traction times (min)	29 (14–47)	23 (17–59)
	*3 patients had no traction	*1 patient had no traction

BMI, body mass index.

at pressures ranging 5–15 mmHg in 4 min inflated/1 min deflated cycles.

Statistical analysis

Non parametric calculations were performed.

The difference in the proportions of patients discharged within 24 hours of surgery (post-operative day 1) were calculated using the Fisher's Exact tests and the doses of PRN analgesia and pain VAS scores were compared using the Mann–Whitney U test.

Statistical significance was set at $P < 0.05$.

RESULTS

The CC group and controls were similar in gender, age, BMI and traction times (Table I).

The CC group reported significantly lower pain scores compared with the controls VAS 1 (0–3) and 2 (0–5) $P = 0.0028$. The reduction in analgesic doses 1.75 versus 2.8 doses per patient, respectively was not statistically significant ($P = 0.77$).

In the CC group 20/20 patients were discharged on post-operative day 1 versus 17/20 in the control group ($P = 0.23$). The specific procedure performed to each patient, traction times and analgesic doses required are detailed in Table II.

18/20 CC patients reported satisfaction with the system and believed that it improved their level of post-operative pain, and none requested the CC device to be removed.

There were no complications related to the use of the CC system. Although 2/20 patients described disturbances during sleep (noise and positioning).

The *post-hoc* power analysis based on these 40 patients has shown power of 80, 43.4 and 15% for VAS pain levels, LOS and doses of analgesia, respectively.

For a power of 80% and confidence of 95% with significance set at $P > 0.05$, the numbers required in each group would be 20, 48 and 190 for VAS pain levels, LOS and doses of analgesia required, respectively.

DISCUSSION

Post-operative pain minimization is critical to the patient experience of surgery.

In this study we found that patients treated with CC after hip arthroscopy were able to be discharged home sooner and reported lower levels of pain during the early post-operative phase. There was also a tendency towards less analgesic requirement associated to CC.

Multiple strategies have been proposed to manage early post-operative pain while minimizing adverse effects. An ideal pain management strategy should be effective, simple, safe and allow early mobilization.

Ward *et al.* in a comparative study of regional blocks versus opioids reported longer LOS and higher rates of nausea when opioids were used [9]. Multimodal analgesia including a fascia iliaca block allowed for reduced doses of opioids with its benefits in nausea incidence in a study conducted by Krych *et al.* [10]. In another study comparing femoral nerve blocks versus placebo in hip arthroscopy patients, better pain control in the firsts 6 h was reported with blocks, although a rebound effect in pain at 24 h and higher incidence of falls (6/27 versus 0/23 patients) was acknowledged [11]. In the present study reported pain and requirements of opioids were relatively low in both groups, which would suggest that invasive analgesic procedures may not be necessary in this group of patients. In terms of compliance and safety CC showed an excellent compliance with no patients asking for the device being turned off or removed and only mild disturbances related to the noise produced by the pump reported by a single patient. No complications related to the device were reported. As the temperature of the circulating fluid is limited to 0°C (mixture of solid and liquid water) and the presence of two layers of material between the fluid and patients' skin, it offers a low risk for skin irritation which is occasionally seen with SC if applied in direct contact to skin.

CC has showed benefits in pain management in shoulder and knee arthroscopy and also in hip replacement surgery [7, 8, 12, 13]. Although it is reasonable to expect comparable results in hip arthroscopic surgery, this work has not been done before. Similar to these previous reports, our results showed improved pain scores adding CC to standard analgesia management.

Table II. Procedures performed, age, traction times, VAS pain, analgesia administered, hospital stay

Patient	*Age*	*Procedures performed*	*Traction time*	*VAS pain score*	*Doses of analgesia requested*	*Hospital LOS (days)*
CC						
1	61	ITBR/Glut repair	0	2	1	1
2	52	FOC + LabR	14	3	1	1
3	36	Combined + LabR + LT	30	3	3	1
4	20	FOC + LabR + LT	31	3	8	1
5	38	MF + LT + CP	28	2	3	1
6	38	Combined + LabR	47	2	6	1
7	46	LabR + LT	21	0	0	1
8	22	FOC + LT	23	0	0	1
9	15	LT + LabR + CP	19	0	0	1
10	27	LT + LabR + CP	22	0	0	1
11	48	FOC + MF + LT	41	1	2	1
12	22	LabR + MF + LT	25	3	2	1
13	45	LabR +LT	20	2	1	1
14	27	AOC + LT	33	1	3	1
15	32	FOC + MF + LT	39	1	2	1
16	33	LabR + LT + CP	17	2	1	1
17	16	FOC + LabR + LT	35	0	0	1
18	65	ITBR/Glut repair	0	0	0	1
19	35	FOC + LT + CP	35	1	0	1
20	63	ITBR/Glut repair	0	1	2	1
SC						
1	44	AOC + LabR + LT	59	2	0	1
2	60	FOC + LabR	23	3	2	1
3	23	LT + CP	17	3	1	2
4	47	LT	21	3	5	2
5	38	MF + LabR + CP + LT	31	2	0	1
6	28	FOC + LabR	23	2	5	1
7	45	FOC + LabR	21	0	19	2
8	34	FOC + LabR + LT	20	0	8	1

(continued)

Table II. (continued)

Patient	Age	Procedures performed	Traction time	VAS pain score	Doses of analgesia requested	Hospital LOS (days)
9	37	AOC + LT	18	0	2	1
10	32	LT + CP	36	0	1	1
11	62	FOC + LabR	21	1	2	1
12	20	AOC + LT	22	3	0	1
13	23	LT + CP	20	2	1	1
14	22	AOC + LabR + LT	45	1	0	1
15	35	LT + CP	22	1	1	1
16	46	LabR + MF + LT + CP	45	2	1	1
17	18	Combined + LT + CP	46	0	2	1
18	54	ITBR/Glut repair	0	0	0	1
19	37	AOC	27	1	0	1
20	21	Combined + LabR	51	1	6	1

FOC, femoral osteochondroplasty; AOC, acetabular osteochondroplasty; combined: femoral + acetabular osteochondrolasty; LT, ligamentum teres debrided; CP, capsular plication; LabR, labral repair.

The benefits related to CC therapy were present while the system was used (early post-operative inpatient period) and no benefits in long-term outcomes are expected. Similarly, Saito *et al.* showed lower pain scores and analgesic use in the first 4 days after THA [13]. Although it is feasible to continue CC use after hospital discharge, the patients need to arrange to hire the device at their additional cost. As pain after discharge is rarely a problem, ongoing CC at home is not included routinely in the author's practice.

A larger prospective trial should be carried out to confirm these results, the results here provided allowed an adequate sample size calculation for that trial. A cost-effectiveness analysis might further help clinicians determine if CC is an intervention which warrants inclusion in their early post-operative pain management, especially if it could lead to a reduction in opioids requirements where they are routinely used.

CONCLUSION

CC is superior to simple cryotherapy alone, and leads to improved post-operative pain relief, earlier discharge and possibly decreasing post-operative analgesic requirements after hip arthroscopy.

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CONFLICT OF INTEREST STATEMENT

None declared.

REFERENCES

1. Nwachukwu BU, Rebolledo BJ, McCormick F *et al.* Arthroscopic versus open treatment of femoroacetabular impingement: a systematic review of medium-to long-term outcomes. *Am J Sport Med* 2015; **44**: 1062–8.
2. Mansell NS, Rhon DI, Meyer J *et al.* Arthroscopic surgery or physical therapy for patients with femoroacetabular impingement syndrome: a randomized controlled trial with 2-year follow-up. *Am J Sports Med* 2018; **46**: 1306.
3. Griffin DR, Dickenson EJ, Wall PDH *et al.* Hip arthroscopy versus best conservative care for the treatment of femoroacetabular impingement syndrome (UK FASHIoN): a multicentre randomised controlled trial. *Lancet* 2018; **391**: 2225–35.
4. Bennell KL, Spiers L, Takla A *et al.* Efficacy of adding a physiotherapy rehabilitation programme to arthroscopic management of femoroacetabular impingement syndrome: a randomised controlled trial (FAIR). *BMJ Open* 2017; **7**: e014658.
5. Ayyar Gupta V, Andrade T, Pollard TCB *et al.* Arthroscopic hip surgery compared with physiotherapy and activity modification for the treatment of symptomatic femoroacetabular

impingement: multicentre randomised controlled trial. *BMJ* 2019; **364**: l185. doi: 10.1136/bmj.l185.

6. Willimon SC, Briggs KK, Philippon MJ. Intra-articular adhesions following hip arthroscopy: a risk factor analysis. *Knee Surgery Sport Traumatol Arthrosc* 2014; **22**: 822–5.
7. Leegwater NC, Willems JH, Brohet R *et al*. Cryocompression therapy after elective arthroplasty of the hip. *Hip Int* 2012; **22**: 527–33.
8. Song M, Sun X, Tian X *et al*. Compressive cryotherapy versus cryotherapy alone in patients undergoing knee surgery: a meta-analysis. *Springerplus* 2016; **5**: 1–12.
9. Ward JP, Albert DB, Altman R *et al*. Are femoral nerve blocks effective for early postoperative pain management after hip arthroscopy? *Arthrosc J Arthrosc Relat Surg* 2012; **28**: 1064–9.
10. Krych AJ, Baran S, Kuzma SA *et al*. Utility of multimodal analgesia with fascia iliaca blockade for acute pain management following hip arthroscopy. *Knee Surgery Sport Traumatol Arthrosc* 2014; **22**: 843–7.
11. Xing JG, Abdallah FW, Oldfield S *et al*. Pre-operative femoral nerve block for hip arthroscopy: a randomized controlled trial. *Orthop J Sport Med* 2015; **3**: 2325967115S00084. doi: 10.1177/2325967115S00084.
12. Perna M, Su EP, Mayman DJ *et al*. A prospective, multi-center, randomised trial to evaluate the efficacy of a cryopneumatic device on total knee arthroplasty recovery. *J Bone Joint Surg Br* 2012; **94**: 153–6.
13. Saito N, Horiuchi H, Kobayashi S *et al*. Continuous local cooling for pain relief following total hip arthroplasty. *J Arthroplasty* 2004; **19**: 3334–337.