

Theme issue: Cryotherapy

K. Ammer

Ludwig Boltzmann Research Institute for Physical Diagnostics, Vienna, Austria

The term cryotherapy covers a wide range of therapeutic applications of cold for heat removal. Various techniques of cryosurgery use the destructive power of low temperatures on cells to destroy skin tumours such as warts (1) or to treat metastatic neoplasms in internal organs (2). The more traditional form of cold treatment applies ice, cold packs or cold air or gas to alleviate pain, reduce swelling after trauma or decrease rheumatic inflammation. Temperature changes on the surface of the human body, internal soft tissues and the intra-articular cavity during heat removal are investigated for 6 decades. Some of these studies used infrared thermal imaging for the determination of temperature changes (3). However, there are still gaps in our knowledge with respect to the relationship between physiological changes and clinical effectiveness. New cooling devices have been recently developed which may be more effective than traditional methods of cryotherapy (4). The effectiveness of ice treatment in acute soft tissue injury is still under debate (5). Soft tissue thermodynamics before, during, and after cold therapy are not fully understood and require further research (6).

3 papers in this issue of *Thermology international* report the response to various cooling procedures. A group of Polish medical physicists and physiatrists describe the effect of whole body cryotherapy on the skin temperature of the back in healthy subjects and in back pain sufferers (7). They found more variations in the pattern of temperature distribution immediately after cryotherapy than prior to the cold treatment. They conclude, that cooling with nitrogen gas may increase the diagnostic power of infrared imaging in back pain syndromes. Whole body cryotherapy, originally developed in the eighties in Japan as a treatment option for rheumatoid arthritis (8), has recently gained new interest. A group from Finland described the changes of mean skin temperature and core temperature after a two minutes stay in a cold chamber at -110°C (9). Skin temperature was determined by insulated thermometers taped to the skin. Very low temperatures were recorded in the forearm and the calf. Another group from Poland have reported preliminary results of whole body cryotherapy showing an alleviating effect on depression (10).

The Medical Imaging Research Group of the University of Glamorgan has investigated the temperature lowering effect of a topical agent containing menthol (11). They observed a slightly longer lasting cooling effect of the gel if it was evenly spread on the skin than after rubbing a fixed quantity into the skin. The volunteers described the subjective effect of the gel as comfortable cooling. The authors have also compared the cooling effect of the gel to topical

treatment with ice (12). The full version of this investigation is already submitted and will appear in the next issue of this journal. The abstract (12) clearly stated, that ice treatment results in a rapid decrease of temperature and quick recovery after removal, whilst the temperature fall induced by the cold gel is more gradual but long lasting. Finally, the clinical effect of the treatment with a cold gel in sports-related soft tissue injury was reported from a prospective randomised double-blinded controlled study (13). The cold gel group showed significantly more pain reduction, less disability and more satisfaction with treatment than the placebo group.

In the third paper (14) a different response to a cold challenge applied to the hands was observed in young and elderly people. This study from Norway clearly shows that elderly people have colder hands and feet than young subjects, and need also more time to recover their skin temperature after cold stress. Further investigation is required to show if a similar response can be expected after cryotherapy.

These three papers demonstrate nicely various physiological effects of local and more generalized heat removal. The resulting changes of skin temperature can easily be recorded by infrared thermal imaging. This technique has many advantages compared to local contact thermometers and is recommended for future investigations in thermal physiology.

References:

1. Huang A, McCall JM, Weston MD, Mathur P, Quinn H, Henderson DC, Allen-Mersh TG. Phase I study of percutaneous cryotherapy for colorectal liver metastasis. *Br J Surg* 2002; 89(3): 303 - 310
2. Connolly M, Bazmi K, O'Connell M, Lyons JF, Bourke JF. Cryotherapy of viral warts: a sustained 10-s freeze is more effective than the traditional method. *Br J Dermatol*. 2001; 145(4): 554-7.
3. Ammer K. Effects of Thermotherapy Determined by Infrared Measurement. *Physica medica* (in press)
4. Warren TA, McCarty EC, Richardson AL, Michener T, Spindler KP. Intra-articular Knee Temperature Changes. Ice Versus Cryotherapy Device. *Am J Sports Med* 2004; 32(2): 441-445
5. Bleakley C, McDonough S, MacAuley D. The Use of Ice in the Treatment of Acute Soft-Tissue Injury. A Systematic Review of Randomized Controlled Trials. *Am J Sports Med* 2004; 32(1): 251-261
6. Enwemeka CS, Allen C, Avila P, Bina J, Konrade J, Munns S. Soft tissue thermodynamics before, during, and after cold pack therapy. *Med. Sci. Sports Exer.* 2002; 34(1), 45-50

7. Cholewka A, Drzazga Z, Sieron A, Wisniowska B. Temperature Effects of Whole Body Cryotherapy Determined By Thermography. *Thermology international* 2004, 14: 57-63
8. Yamauchi T. Whole body cryotherapy is method of extreme cold -175°C treatment, initially used for rheumatoid arthritis. *Z Phys Med Baln Klim* 1986;19: 311.
9. Westerlund T, Oksa J, Smolander J, Mikkelsen M. Thermal responses during and after whole-body cryotherapy (-110°C). *J Therm Biol* 2003; 28: 601–608
10. Rymaszewska J, Tulczynski A, Zagrobelny Z, Kiejna A, Hadrys T. Influence of whole body cryotherapy on depressive symptoms –preliminary report. *Acta Neuropsychiatrica* 2003: 15: 122–128.
11. EF Ring, C. Jones, P. Plassmann, K. Ammer. Cooling effects of Deep Freeze Cold Gel applied to the skin of the lumbar region of the back. *Thermology international* 2004, 14:61-67
12. Ring EFJ, Ammer K, Plassmann P, Jones C, Bola T. Thermographic Study of Topical Cooling Agents for the Skin (abstract). *Thermology international* 2004; 14: 77
13. Airaksinen OV, Kyrklund N, Latvala K, Kouri JP, Grönblad M, Kolari P. Efficacy of Cold Gel for Soft Tissue Injuries. A Prospective Randomized Double-Blinded Trial. *Am J Sports Med* 2003; 31:680-684
14. Rasmussen LK, Mercer JB. A comparison of thermal responses in hands and feet of young and elderly subjects in response to local cooling as determined by infrared imaging. *Thermology international* 2004, 14:68-74

Address for correspondence

Prof Kurt Ammer MD, PhD

Ludwig Boltzmann Research Institute for Physical Diagnostics,
Hanuschkrankenhaus, Heinrich Collinstr 30,
A-1140 Vienna, Austria