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Infrared Thermographic Investigation of Fingers and Palms During and After Application of Cuff Occlusion Test In Patients With Hemorrhagic Shock

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SUMMARY

BACKGROUND: Measurements of skin temperature has been used to predict the chance for survival in critically ill subjects since 1969.

AIM OF THE STUDY: To investigate the predictive power of the dynamics of the finger temperature after application of external occlusion of arm perfusion for 2 minutes.

METHOD: By means of infrared thermography, the dynamics of finger and palm temperature was investigated before, during and after the two-minute of cuff occlusion test in 14 healthy volunteers and 25 patients, who have been treated at the department of anesthesiology and critical care for "hemorrhagic shock" in the period 2010 to 2012.

RESULTS: Prior to the occlusion of blood flow, distribution of isotherms in infrared images of fingers and palms recorded in healthy volunteers and in patients with hemorrhagic shock was almost the same and also absolute temperature values were found in the same range of magnitude . The temperature dynamics and the isotherm distribution at the palm differed between surviving and non-surviving patients under shock. 1 to 1.5 minutes after restoration of perfusion in the brachial artery, healthy control subjects and surviving patients presented with a rise in temperature and restoration of the baseline pattern of temperature distribution, while a decrease in temperature and an expansion of the area of low temperature isotherms was observed in non-survivors.

CONCLUSION: The proposed assessment of dynamics of hand temperature is a promising test to predict the survival of patients under hemorrhagic shock. Further investigations are warranted.

KEY WORDS: temperature, shock, hypoxia, health, death, prediction.

INFRAROT-THERMOGRAPHISCHE UNTERSUCHUNG DER FINGER UND HANDFLÄCHEN WÄHREND UND NACH DER ANWENDUNG EINER BLUTSPERRE BEI PATIENTEN IM HEMORRHAGISCHEN SCHOCK

HINTERGRUND: Seit 1969 werden Messungen der Hauttemperatur verwendet, um die Chance zum Überleben von kritisch kranken Patienten vorherzusagen.

ZIEL DER STUDIE war es. die Vorhersagekraft der Dynamik der Fingertemperatur nach Anwendung einer externen Blutsperre am Oberarm für 2 Minuten zu untersuchen.

METHODE: An 14 gesunden Probanden und 25 Patienten, die im Zeitraum von 2010 bis 2012 am Institut für Anästhesiologie und Intensivmedizin wegen "hämorrhagischen Schocks" behandelt worden sind, wurde mittels Infrarot-Thermografie die Dynamik der Finger- und Handflächen-Temperatur vor, während und nach einer zweiminütigen Blutsperre untersucht.

ERGEBNISSE: Es zeigte sich, dass bei gesunden Probanden und bei Patienten mit hämorrhagischem Schock die Verteilung von Isothermen in Infrarot-Bildern von Fingern und Handflächen vor der Blutsperre ähnlich war und auch die absoluten Temperaturwerte befanden sich in der gleichen Größenordnung. 1 bis 1,5 Minuten nach Wiederherstellung der Durchblutung der Arteria brachialis reagierten gesunde Kontrollpersonen und überlebende Patienten mit einem Anstieg der Temperatur und der Wiederherstellung der ursprünglichen Temperaturverteilung, während bei nicht-überlebenden Patienten eine Abnahme der Temperatur und eine Zunahme der Fläche von Isothermen geringer Temperatur beobachtet wurde.

SCHLUSSFOLGERUNG: Die vorgeschlagene Bewertung der Dynamik der Handtemperatur ist ein viel versprechender Test, um das Überleben der Patienten unter hämorrhagischem Schock vorherzusagen. Weitere Untersuchungen sind gerechtfertigt.

SCHLÜSSELWÖRTER: temperatur, Schock, Hypoxie, Überleben, Tod, Vorhersage

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Introduction

Low emittance of infrared radiation from fingers and palms can be caused by several conditions such as convective [1] or conductive cooling [2], external occlusion of blood flow due to applied cuffs or torniquets [3], Raynaud´s phenomenon [4] or internal vascular obstruction caused by thrombi formation [5] or arterial intimal

proliferation and capillary destruction in the case of systemic sclerosis [6]. The effect of toxins such as in ergotism [7] or tobacco smoking may result in reduced finger perfusion and consecutive cold fingers [8,9]. Centralisation of blood distribution in fainting [10,11] or in shock with or without reduced breathing function [12,13] leads also to low temperatures of fingers and hands.

Shock is described as a condition in which tissue perfusion is not capable of sustaining the aerobic metabolism. Significant loss of intravascular blood volume caused by major trauma may lead sequentially to hemodynamic instability, decreased tissue perfusion, cellular hypoxia, organ damage, and death [14]. Based on blood loss, pulse rate, blood pressure, breathing rate, urine output and symptoms of central nervous system, the Committee on Trauma of the American College of Surgeons developed the Advanced Trauma Life Support system (ATLS) which defined 4 classes of haemorrhage. Patient with blood loss of 30 to 40 percent and consecutive hemorrhagic shock belong to class III. Besides hypovolemia, acute traumatic coagulopathy threatens the life of the patient [15].

Low skin temperature as a clinical sign of patients in shock due to injuries was already published in 1867 [16]. 102 years later, Joly and Weil reported that the temperature of the great toe can be used for assessment of the severity of shock [17]. The reported a good correlation with cardiac output (r=0.73) and found a high likelihood of death (67%) if the toe temperature, 3 hours after admission, was less than 27°C, or if the difference between toe and ambient temperatures was less than 2°C. The temperatures of the distal pad of the middle finger and of the great toe were moderately correlated (r=0.53) and the authors concluded that similar information about the severity of shock and survival are available from finger temperature. The use of skin temperature and temperature gradients (central to peripheral, peripheral to ambient) have been reviewed [18,19]. Measures of variability of the temperature signal in the time domain showed a good correlation with the Sequential Organ Failure Assessment (SOFA) score and also high predictive power for mortality in critically ill patients [20] and in patients with sepsis [21].

Temperatures derived from infrared images of hands may help to assess extent of hypoxic and ischemic damage [22, 23]. It is assumed that in patients with blood volume loss of 30 to 40%, the dynamics of hand temperature may also identify significant patterns associated with the severity of pathology that may predict either death or survival due to the available resources for recovery (24).

To verify the predictive power of finger temperature for the survival of adult patients with hemorrhagic shock, we conducted a study to investigate the dynamics of the temperature of fingers and palms by employing infrared thermography.

Method

The temperature dynamics of fingers and palms was studied with infrared thermal images before, during and after two-minutes of provoked ischemia of the right hand (cuff occlusion test) in 14 healthy volunteers (group 1) and in 25 patients, who underwent treatment at the department of anaesthesiology and critical care with the diagnosis of hemorrhagic shock (group 2) in the period between 2010 and 2012.

The diagnosis of hemorrhagic shock was based on the ATLS system. Conscious patients, who were able to provide informed consent for participation and who have been classified as shock class III, were included. The study plan was previously approved by the Ethics Committee of the Izhevsk State Medical Academy following the principles that are outlined by the World Medical Declaration of Helsinki (25).

To occlude blood supply to the right arm, an inflatable cuff was attached around the right upper arm, inflated to a value 30mm Hg above the subjects systolic blood pressure and kept in place for 2 minutes. The occlusion test was performed within 3 hours after admission to the critical care ward.

Infrared monitoring of temperature of hands was performed by using the thermal imager ThermoTracer TH9100XX (NEC, USA). Ambient temperature of the examination room was 24 ± 25°C, the temperature window of the thermal camera was set to the range of 25 to 36°C. Infrared thermal images of the right palm and the palmar surface of the fingers were recorded prior to, during and after the occlusion test at time interval of 30 seconds.

The obtained data were processed using the software Thermography Explorer and Image Processor. A region of interest was defined over the entire hand using the outline of the hand to separate the hand temperature from the background. From this region of interest, we determined the mean temperature, standard deviation and distribution of isotherms at the thresholds of 34, 32, 30, 29 and 25° C. In addition, spot temperatures of the finger tips were measured. Mean finger temperature was calculated by averaging the finger tip temperature of the 2nd to the 5th finger. The thumb was excluded from temperature measurements as it usually carried a pulsemeter (figure 2).

Results

Prior to the occlusion test, baseline readings of temperature of fingers and palms were in healthy adult control subjects in the range of 24 to 36 °C, and in patients with hemorrhagic shock in the range of 24 to 30 °C. The mean temperature of finger of healthy volunteers was 33.0 ± 1.2 °C (n = 14), and in patients with shock 26.3 ± 1.2 °C (n = 25). Prior to the deliberate occlusion of blood supply of the right arm, the full range of isotherms at thresholds of 34, 32, 30, 29 and 25° C was visible on the thermal images from healthy volunteers and patients with hemorrhagic shock.

Removed pulsations of the radial artery due to cuff inflation at the upper arm, lead to hypothermia of hands in both healthy volunteers and patients with hemorrhagic shock. In particular, at the end of ischemia for 2 minutes the mean temperature of the fingers tips was 31.8 ± 0.8 °C (n = 14) in the group of volunteers, and 24.5 ± 0.5 °C (n = 25). in the group of patients with hemorrhagic shock. Fingers tips of all investigated subjects presented with

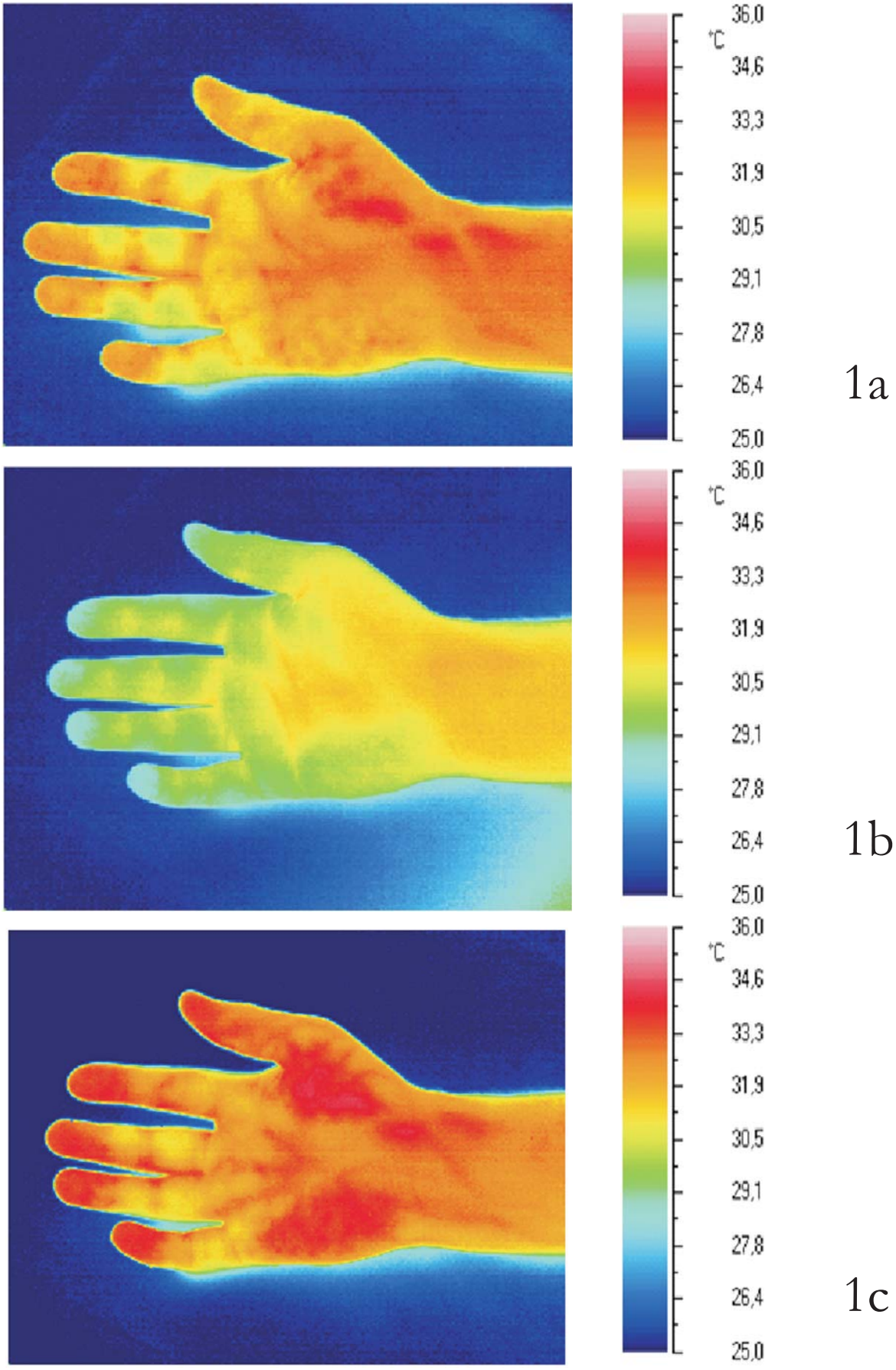

Figure 1.
Infrared image of the palmar surface of the right hand of healthy volunteers (male N, 37 years):
1a - prior to the occlusion
1b -2 minutes after external the creation of the brachial artery
1c - 60 seconds after the elimination of occlusion and restoration of blood flow in the brachial artery

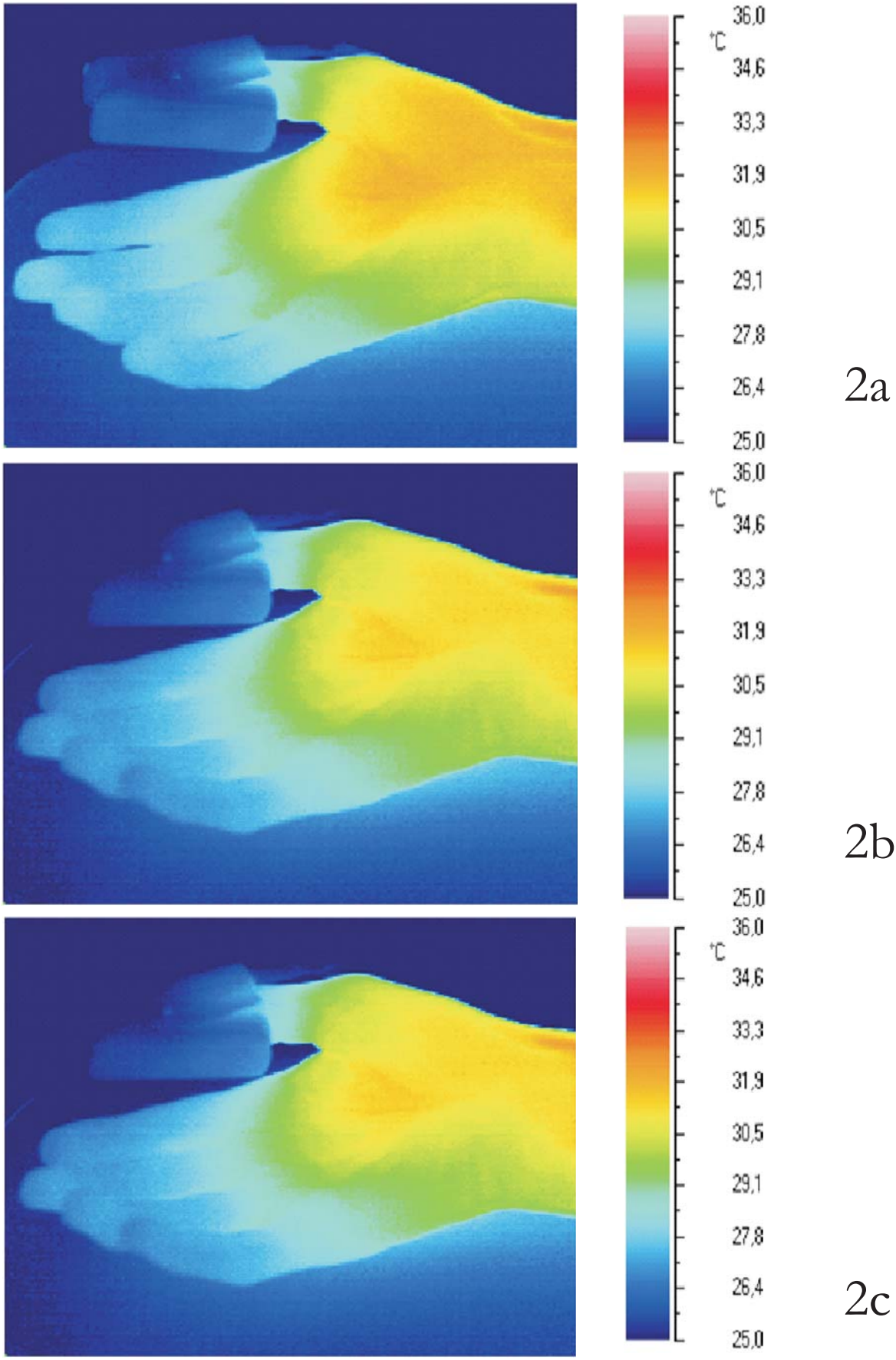

Figure 2.
Infrared image palmar surface of the right of the hand of patient with hemorrhagic shock (patient T., 47 years old) at admission to the hospital (the patient died within 48 hours despite treatment:
1a - prior to the occlusion
1b -2 minutes after external occlusion of the brachial artery
1c - 60 seconds after the removal of the cuff and restoration of blood flow in the brachial artery

isotherms corresponding to a temperature range between 25 and 28° C.

After removing the cuff and restoring blood flow in the hand, the dynamics of temperature and the distribution of isotherms in fingers and palms of healthy and ill people differed from each other. In particular, 2 - 3 seconds after the after release of the external occlusion, the finger temperatures in healthy volunteers started to rise and reached baseline values after 50 - 60 seconds. 60- 90 seconds after restoration of blood flow, the temperature of fingers exceeded the initial values by 0.1 - 1.0 °C and the image of the fingers on the display of the thermal imager changed colours from blue (25-28°C) to red (31-34°C) (Figure 1). The hyperthermia of fingers was preserved throughout 4.9 ± 0.25 minutes and after that, temperature returned to the initial level.

In 4 out of 25 patients with hemorrhagic shock, tem. perature of fingers and palms continued to drop slightly after 2 minutes of deliberate ischemia, and infrared images remained in low temperature isotherms corresponding with a temperature between 25 and 29° C. It is important to emphasize that despite intensive therapy, repeated application of the cuff occlusion test in these 4 patients did not result in a period of increasing the finger temperature by 0.1 - 1.0 C and did not change the colours in infrared images of fingers and palms from blue to red (Figure 2). These 4 patients died within 24 - 48 hours after admission to the intensive care unit.

In the other 21 of the 25 patients, their temperature of the fingers and hands recovered slowly to the baseline values after release of perfusion occlusion. The isotherms in the infrared images of these patients changed gradually from low temperatures (represented by blue colour) to high temperatures indicated by red-orange-yellow-green colours. All these 21 patients were successfully treated and survived hemorrhagic shock.

Discussion

Low temperature of fingers and palms indicate not always a critical state of health of patients. Therefore, the detection of hypothermia in the fingers and palms are not sufficient to establish a condition of hypoxia and/or ischemia in case of hemorrhagic shock. With this respect, we investigated after short-term occlusion of blood supply rather the dynamics of temperature than the absolute values in fingers and palms.

Analysis of the data revealed that 1 - 1.5 minutes after re-establishing perfusion, the dynamics of temperature and the distribution of isotherms in false-coloured infrared images of fingers and palms showed differences in potentially surviving and non-surviving patients. In healthy control subjects and in surviving patients the finger temperature and the distribution of isotherms on palms and fingers completely recovered after cuff occlusion test, but in non-surviving patients the temperature pattern was not restored.

Based on our study results, we propose thermographically recorded temperature changes of the hand that became obvious 1 to 2minutes after release of cuff occlusion as a new functional test, which might be able to predict the survival of patients with hemorrhagic shock. A rise in temperature by 0.1 - 1.0° C in the hypothermic area of hand, a reduction of the extent of the area of hypothermia and restoration of the baseline pattern of isotherms is regarded as a negative test result indicating high probability of survival due to sufficient resources for recovery. A positive test result is characterized by the lack of temperature recovery, continued decrease of finger temperature and a persistent or increasing extent of the area of hypothermia. All patients with positive test results died within 48 hours after admission to the critical care unit. We interpret our preliminary findings in the way that a positive test result of the cuff occlusion test is a strong predictive sign of poor chance for survival.

One limitation of this study is that the results of the cuff occlusion test were not compared to other measures of blood quality or quantity or assessments of hypoxia of the central nervous system. Our primary intention was to describe the typical development of hand temperature after short-time occlusion of the blood supply of the forearm and hand in healthy subjects, in patients who survived a class III hemorrhagic shock and in non- surviving patients. necessary to assess the extent of the loss of blood and diagnostic degree of hemorrhagic shock. A future prospective study must confirm our results in a large cohort of patients, in which correlation of the cuff occlusion test with other vital parameters and established predictive scores for survival will be investigated.

Conclusion

This study supports the value of temperature related measurement in prediction of the chance of survival of critically ill patients under hemorrhagic shock. The proposed proposed assessment of the dynamics of hand temperature which develops after short-time external occlusion of the arm perfusion, is a save, simple, easily to-perform and inexpensive procedure which warrants further investigation.

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Roberto Nascimento Maciel, DDS
Soraya Hladu, DPT

PROGRAMME

Saturday, November 23rd

8-8:30h Postural thermography assessment – *Marcos Leal Brioschi, MD, PhD*

9-9:30h Medical expert thermography examination – *Juliana Badaró, MD*

10-10:30h Thermographic semiology in abdominal pain – *Antonio Claudio Goulart Duarte, MD, PhD*

10:30-11h Thermography in low back pain and sciatica – *Joaci Araújo, MD*

11:30-12h Endothelial dysfunction: Doppler ultrasound or thermography? – *Edmar Santos, MD*

12:30-13:30h Lunch

13:30-14h Infrared thermal imaging for fever detection in children – *Ricardo Vardasca, PhD*

14-14:30h Myofascial trigger points: ultrasound or thermography? – *Giovanna Abreu Franco, MD*

15-15:30h Coffee

15:30-16h Ethical and legal aspects of medical thermography – *Francisco MRM Silva, MD, PhD*

16-16:30h The "mantle sign": How thermography can help to support the clinical diagnosis of fibromyalgia syndrome? – *Marcos Leal Brioschi, MD, PhD*

16:30-17h Small fiber neuropathy and diabetes: thermography provocative tests is feasible? – *Luciane Fachin Balbinot, MD, PhD*

17-18h Degree ceremony for the postgraduate students of the Clinical Thermology and Thermography Specialty 2011-2013

Sunday, November 24th

8-18h Medical thermography oral presentations –
Postgraduate students of Clinical Thermology and Thermography Specialty 2013-2015

Abstracts

THE "MANTLE SIGN": HOW THERMOGRAPHY CAN HELP TO SUPPORT THE CLINICAL DIAGNOSIS OF FIBROMYALGIA SYNDROME?

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Fibromyalgia (FM) syndrome is a chronic condition characterized by musculoskeletal pain that persists for many years and is unresponsive to anti-inflammatory and analgesic compounds. There is an overlap between thermoregulation and the modulation of nociception that are consistent with the symptoms of FM (Larson et al, 2013):

1.Cold intolerance

2.Decreased body temperature (low metabolic rate)

3.Distribution of brown adipose tissue (BAT) resembles that of tender points (TP) (Jeschonneck, 2000)

4.BAT activity at rest and the incidence of FM are each relatively greater in females than males (whereas adaptive thermogenesis is greater in males than females)

5.Stress and cold each stimulate thermogenesis and aggravate symptoms of FM (whereas warmth suspends thermogenesis and temporarily relieves the symptoms of FM)

6.Regulation of thermogenesis and pain share several areas in the brain where they may influence each other

7.Sensitive to sympatholytic maneuvers: injections of a local anesthetic into stellate ganglia (sympathetic projections to subclavicular BAT) reduce pain in patients with FM (Bengtsson , 1988)

8.Rekindles upon injection with norepinephrine

9.Polymorphisms in catechol-o-methyl transferase have been linked to FM (faulty degradation of catecholamines increases the risk of developing FM)

10.Extended programs of exercise relieve symptoms of FM (improve thermoregulation, decrease adrenergic activity, and inhibit recruitment of BAT)

Nerves projecting to BAT are located near regions surrounding tender points (TP), primarily in the supraclavicular region, and also in supra axial, perirenal, and subcutaneous areas. Eighteen TP distributed symmetrically on the trunk and proximal regions of limbs rather than areas that are usually more sensitive to tactile stimulation in healthy individuals, such as hands, feet, genitals, and mouth were defined by the American College of Rheumatology. This anatomic overlap provides collateral innervation of tissue adjacent to BAT, for example, skin and muscle, by sympathetic and primary afferent nerves. Thermogenic activity is increased by the same conditions that exacerbate the symptoms of FM, that is, cold and mild daily stress. BAT undergoes "recruitment" (increased mass) in response to repeated cold, repeated stress and overfeeding with diets chronically high in calories. Consistent with this, when BAT is activated by injections of adrenaline in rats, muscles surrounding interscapular BAT have greater blood flow than in muscles of the anterior limbs indicating that adjacent tissues operate in synergy with BAT (Sbarbati, 2006). Sympathetic activity that induces thermogenesis is poised to induce hyperalgesia in tissues surrounding BAT by referred pain.

One model of FM based on repeated exposures of rodents to cold depends on spinal substance P activity for hyperalgesia (Nishiyori, 2008). Substance P, released from primary afferent C-fibers transmitting pain or temperature, causes vasodilation in skin to dissipate heat and induces hyperalgesia. Thus pain can result from the combined effect of substance P along nociceptive pathways together with sympathetically mediated hyperalgesia in skin and muscle surrounding BAT, similar to the pain of angina.

Interscapular brown fat can be readily seen using IR thermography in young rats during cold exposure, in bats during arousal from torpor, in human infants and in human adults (Jackson et al, 2000).

Recently Symonds et al (2012) demonstrated using IR thermography a consistent, and highly localized, increase in local temperature within the supraclavicular region that directly corresponds to the main site of BAT, previously established from PET/CT scans and biopsy studies (Lee et al, 2011).

This is compatible with rapid activation of the sympathetic nervous system, concomitant unmasking of guanodine diphosphate binding sites within uncoupling protein and the stimulatory effect of catecholamines on heat production both in the newborn and in adults. Only a modest standard cool challenge (by placement of the participant's feet or hand in water at 20 C) is required to cause a local temperature increase within this supraclavicular region.

In a well-controlled ambient temperature lab Brioschi et al (2007) described in FM patients a consistent pattern called "mantle sign" that correspond of an exacerbated increase in temperature within the supraclavicular region that can extend to neck and trunk, observed by Biasi et al (1994) as a nonspecific hyperthermic pattern, corresponding to painful muscular areas. The

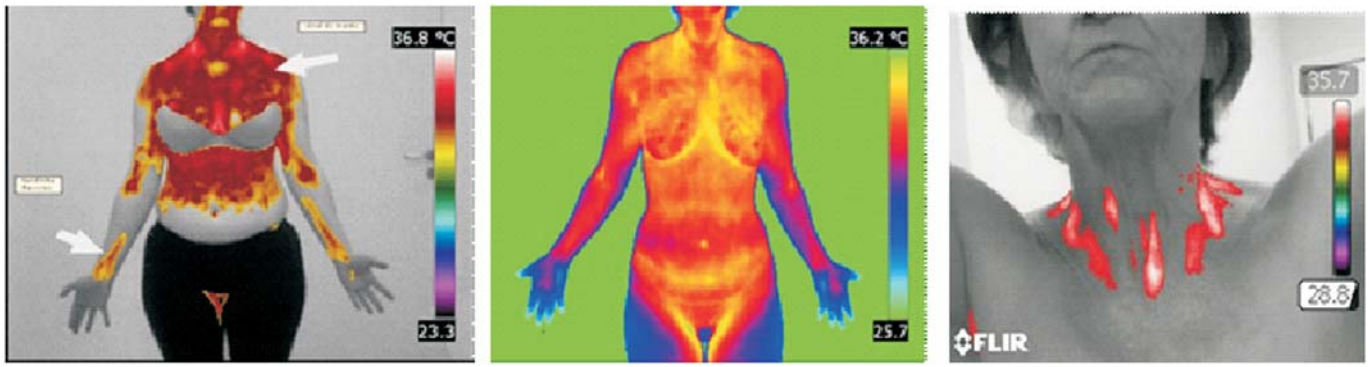

Figure
Thermography shows a hyper-radiation in supra-axial and supraclavicular region ("mantle sign") corresponding to painful areas of tender points in fibromyalgia patients, in contrast with cold hands

authors also related a direct clinical correspondence of these findings with visual analog pain scale during the full body IR thermography of 226 patients and after validated with more 542 evaluations. Most of times, this finding was associated with symmetrical cold hands and periocular hyper radiation. Based on the count of hot spots, 74.2% of 252 subjects have been correctly diagnosed by Ammer et al (2011) described a high consistency of hot spots correlated with TP on upper body with 74.2% of precision in FM patients.

The supraclavicular "mantle sign" observed by IR thermography can be related to the vascular convection that carries in FM patients the overstimulated BAT heat to adjacent vital organs, such as the thoracocervical regions of the spinal cord, heart, and other thoracic organs. Although it is not a definitive diagnosis, the phenomenon of mantle sign can support the clinical dia. gnosis and play an important role in the following of FM patients.

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POSTURAL THERMOGRAPHY ASSESSMENT

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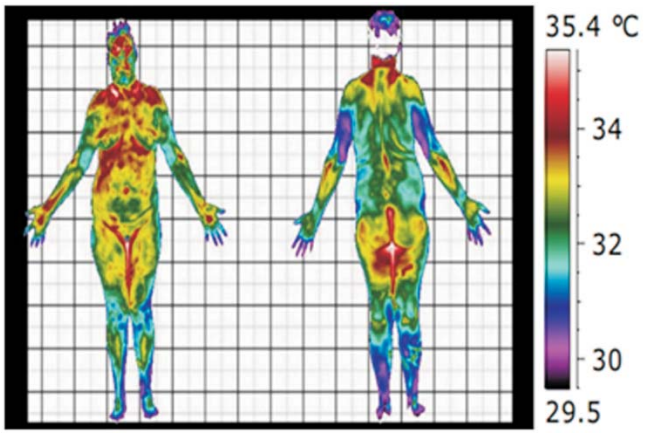
The term ideal posture can be defined as upright position adopted by the human being in perfect equilibrium with gravity action and spending as less energy as possible. This low energetic expenditure is due to a low joint overload, which in turn determines a less intense muscle activity. Postural deviations results in thermal imbalance. Thermal imbalance can cause serious damage combined with misguided physical activity and inappropriate intensity. Thermal imbalances can guide the type of exercise that may or may not to do. Thermal asymmetric patterns (difference between sides) can results from dysfunctions, injuries or pathologies that may be related, and been cause or effect postural changes. Thermography can be implemented for evaluation of biomechanics and muscle overloads during patient treatments, also to identify mechanical overload, to assess muscle fatigue and injury prevention by thermographic biomechanical analysis (TBA). The authors proposed a thermography method to assess posture by anterior, posterior and lateral full body high definition thermal mapping. The analysis involves these three thermography elements: anatomic deviations (horizontal, vertical and spine alignments) and functional overloads and deficits (78 ROI´s delta T measurements of muscles and joints segments). It is also done a biomechanical vector analysis by spot marking of the ROI, a paired plantar surface study with pedothermography and a detailed paraspinal thermography. The TBA or simply Postural Thermography enables to make a quick, accurate and reliable postural diagnosis based on static image as photography. Therefore, it should not replace clinical judgment, but complement it.



Postural thermography assessment.

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ENDOTHELIAL DYSFUNCTION: DOPPLER ULTRASOUND OR THERMOGRAPHY?

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The assessment of vascular reactivity by several methods such as ultrasound, tonometry and contact thermometry is already used

in some institutions in the world. However the methods used so far are very skilled operator dependent and have high cost since they use disposable sensors for performing each test. The authors present an updated protocol for the evaluation of vascular reactivity by skin thermography infrared radiation.

Total Vascular Reactivity (TVR) may be the variable that isolated best expresses vascular reactivity. Gori et al. (2008) failed to demonstrate the importance of flow mediated constriction (FMC) measuring the maximum ischemia (minor axial diameter) of the radial artery by ultrasound. This constriction during brachial artery compression derived from the reduction of the action of endothelium-derived hyperpolarizing factor, increased endothelin 1 and transient reduction in nitric oxide activity. The author has demonstrated that FMC in patients with coronary artery disease offers different policies, additional information regarding FMD and can reclassify alone the cardiac risk of 19% of patients.

We calculated the TVR by infrared thermography similar to the radial ultrasound mode adapting our previous protocol (Santos, Brioschi, Teixeira, 2011)

$$TVR = TR - TMin / Tmin \qquad \text{Eq. (1)}$$

TVR = total vascular reactivity

TR = temperature rebound
(maximum temperature during reactive hyperemia)

TMin = minimum temperature during maximum ischemia
(achieved within 5 minutes)

The initial value of 20 for TVR seems discriminate individuals with alterations in vascular reactivity on our first pilot study with 100 patients.

Patients with good vascular reactivity have regular TVR (>20), normal TR, normal neurovascular opposite hand reaction (NVR) and rapid rise of temperature during reactive hyperemia.

Patients with insufficient vascular reactivity have the above variables changed, and the results could be divided into 6 groups:

Group	TVR	TR	NRV	Reactivity results
	Total Vascular Reactivity	Temperature Rebound	Neuro-vascular Reactivity	
1	Normal	Normal	-	Normal vascular reactivity
2	Low	Low	-	Low vascular reactivity
3	Normal	Low	-	Regular vascular reactivity (borderline)
4	Low	Normal	-	Regular vascular reactivity (borderline)
5	-		Normal	Normal neurovascular reactivity
6	-		Low	Distal sympathetic hyperactivity

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THERMOGRAPHY AND OCULAR UVEITIS.

Alberto Rafael Ferreira Neto MD, Marcos Leal Brioschi MD, Manoel Jacobsen Teixeira, MD

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E.C.D.O. 42y looked for medical care as there was days suffering hyperemia and photophobia in the right eye, which progressed with low visual acuity. He reported uveitis in the right eye at past, but during the ophthalmologist consult nothing was identified. He consulted another medical doctor who decided to do a complementary thermographic exam. It was confirmed an ocular uveitis by infrared imaging that allowed the initial diagnosis and treatment for this patient. Thermography can be a remarkable tool in ophthalmology field and help to the diagnosis of inflammatory eyes diseases.

INFRARED THERMOGRAPHY IN THE PREOPERATIVE PLANNING OF ANTEROLATERAL THIGH PERFORATOR FREE FLAP.

Alexandre Aldred MD, Bernardo Nogueira Batista MD, Marcos Leal Brioschi MD, Manoel Jacobsen Teixeira MD.

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BACKGROUND: The anterolateral thigh free flap is vascularized by one or several perforating arteries arising from the descending branch of the lateral circumflex femoral artery. This flap is large, thin and very versatile and is commonly used for reconstruction of head and neck defects (1). Infrared thermography is an effective tool for the study of cutaneous perfusion and its application in preoperative planning was tested on abdominal perforator flaps for breast reconstruction. (2,3). We briefly describe the use of infrared imaging in the preoperative planning of anterolateral thigh perforator free flap

METHODS: One patient scheduled for anterolateral thigh free flap was selected and kept for thirty minutes in controlled environment (23oC) lay in the bed, with legs exposed. Proceeded anatomical mark of the area of interest and start cooling the area with cotton swab soaked in 70% alcohol for 5 minutes. The perforator was identified by the location of a hot spot on the thermal image during the rewarming of the skin after the cold challenge. The hot spot location was marked and compared with intraoperative findings.

RESULTS: The hot spot observed in the right thigh of the patient corresponded to a perforator identified during the dissection phase.

CONCLUSION: Infrared imaging can be helpful in mapping suitable perforators in preoperative planning of anterolateral thigh perforator free flap.

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THE ROLE OF THERMOGRAPHY IN EVALUATION OF THE SYMPATHETIC NERVOUS SYSTEM.

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A.M.C., male, 50 years old, occupation: electrical technician. Main Complaint: Pain in the right posterior cervical region. The patient referred pain in the right posterior cervical region, radiating from the back side of the right shoulder, side and rear face of the right upper limb until the thumb, which refers paresthesia. A cold stress test was performed, and the right thumb kept the hyper-radiation in the region where the patient complains of paresthesia. Other regions of both hands responded with hypo-radiation. Radiography of cervical spine showed normal bone density, osteophytes and reduced intervertebral spaces between C5 and C6. The diagnosis of this patient could have been based on clinical examination and radiography. However, the confirmation of the sympathetic nervous system involvement was only possible with thermography.

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CUTANEOUS INFRARED THERMOMETRY IN AID TO DIFFERENTIAL DIAGNOSIS OF CHRONIC PAIN AND NEUROGENIC PAIN - CASE REPORT

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CAAS, female, 31 year old. Asked to perform Thermography for chronic pain and suspected of fibromyalgia syndrome. She complained of lower back pain with radiation to the lower limbs and pain relief at rest. After 3 years she evolved with generalized weakness and pain. After one more year of progress she had dystonia in the extremities, generalized pain persisted, worsening by exposing herself to heat. Lumbar CT showed incipient lumbar spondyloarthrosis, mild diffuse bulging of L3-L4 intervertebral disc, small disc protrusions L4-L5 and L5-S1, atrophic pattern of paraspinal musculature on the right and a discrete anterolystesis in L4. Electromyography was normal in upper limb, except for an irregular tremor of the limbs surveyed by 20Hz. Thermography showed a complete asymmetry of the whole body with sympathetic vasomotor instability of the hands after cold stress test and also an asymmetric pattern in medial canthus eyes (territory of internal carotid artery terminal branches), suggesting a neurogenic central dysfunction.

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PREVENTION OF BREAST CANCER ASSISTED BY MEDICAL INFRARED IMAGING

Celso Felício de Carvalho MD, Marcos Leal Brioschi MD, Manoel Jacobsen Teixeira MD

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Over the last 40 years we have seen a dramatic increase of hormonal imbalances in women characterized as precocious puberty before 10 years of age, increased premenstrual syndrome afflicting around 30% of women in peri-menopause, uterine fibroid around 25% among women 35 to 50 years and breast cancer reaching around 10% of all women. Estrogen dominance is a condition in which women can have normal levels, deficient or excessive estrogen but has little progesterone to balance the levels of estrogen. As the infrared imaging can detects thermal changes related with breast cancer, a disease of inflammatory features, these vascular arrangements may be detected and monitored many years before a histologic diagnosis is defined by the biopsy. Since the thermal changes are detected early the authors proposed to search estrogen metabolites that can deregulate the function of breast tissue such as: relationship 2/16 hydroxyestrogen Ratio, 4-hydroxyestrone (4-OHE1), 2-OHE1 (2 hydroxyestrone) / 2-OMe (2 O-methyl estrone) and establish pretreatment with the aim of counteracting and preventing breast cancer.

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THERMAL ANALYSIS OF PATIENTS SUBMITTED TO SPINAL ANESTHESIA

Emerson Yoshinobu Nomura MD, Marcos Leal Brioschi MD, Manoel Jacobsen Teixeira MD

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INTRODUCTION: The spinal anesthesia is the most common kind of anesthesia in patients that undergo to abdominal and lower limbs surgeries. The anesthetic blockade aims to loss of pain sensitivity and temporary motor loss. To identify the anesthesia effectiveness and it´s fail before the occurrence of sensation and motor function loss of the lower limbs is difficult. Thermography can be useful for monitoring the evaluation of the effectiveness of the anesthetic blockade

OBJECTIVE: To analyze the thermographic behavior in patients undergoing spinal anesthesia pre and post spinal anesthesia.

METHOD: Thermograms were done of patients undergoing spinal anesthesia with heavy bupivacaine 5% for gynecological surgery. The pre anesthesia images were took in the operating room with the patient in supine before the anesthetic block was performed, during and after the surgery (Figure 1).

RESULTS: Two pre spinal thermograms in lying position and plantar region of the feet and four post immediate spinal thermograms were collected. The first thermograms established the patient thermal pattern who showed small thermal differences and an average of 4.08oC at the end of the blockage. The more distal thermal analysis the largest thermal difference was found (Table 1).

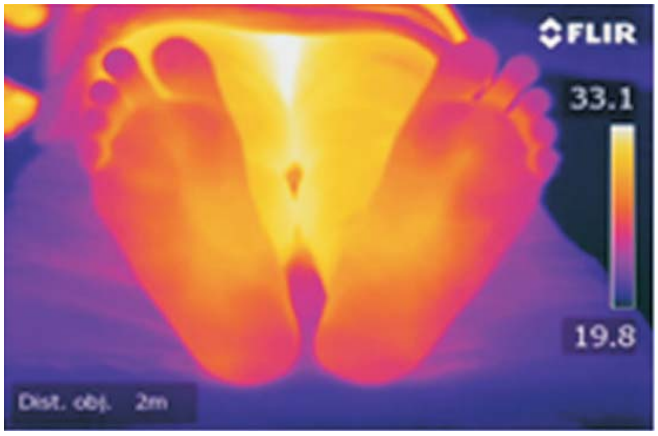

Figure 1a
Thermogram of the plantar feet prior to spinal block

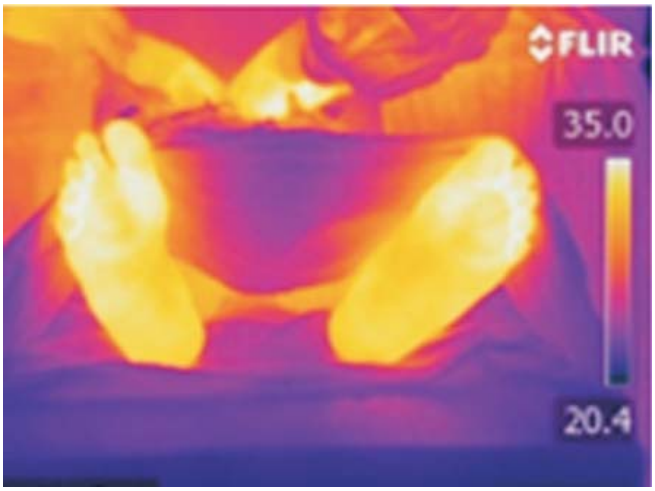

Figure 1a
Thermogram of the plantar feet after spinal block

Table 1
Temperature before and after spinal blocks were applied

		Spinal Anesthetic Block		Delta T (º C)
		Pre (º C)	Post (º C)	
Leg	Right	30.6	32.1	1.5
	Left	30.4	31,7	1.3
	Average	30.5	31.9	1.4
Feet	Right	29.4	33.4	4
	Left	29.8	33.2	3.4
	Average	29.6	33.3	3.7
Plantar	Right	27.5	34,7	7.2
	Left	27.5	34,6	7.1
	Average	27.5	35.65	7.15
TOTAL		4.08		

DISCUSSION: The pre spinal termograms helped to establish the normal thermographic pattern for the patient. The thermograms recorded after anesthetic blockade showed that under the influence of spinal block of sensory, motor, sympathetic and parasympathetic nerve fibers, there is an increase in the temperature in the anesthetized area. These findings data are in agreement with the literature descriptions and in this way thermography contributes to safe anesthesia in our patient.

CONCLUSION: Thermography is an instrument to evaluate the efficacy of anesthetic blockage, and can be used as an indicator of effectiveness of sympathetic branches blocking procedures in pain treatment.

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CASE REPORT: BREAST INFRARED THERMOGRAPHY IN A MAMMOGRAPHIC BI-RADS-3.

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Breast cancer is the most common among women and its incidence has been increasing progressively, both in developed and developing countries, according to the National Cancer Institute (INCA) in Brazil. Death rates remain high, most likely because the diagnosis is done in the advanced stages of the disease. So, it is vital to add complementary exams for early diagnosis, especially which can detect metabolic alterations before morphologic alterations occur. Because computerized infrared thermography is a metabolic exam that quantifies variations of temperature and qualifies abnormal vascular patterns related to regional angiogenesis, neovascularization and regional vasodilation inducted by nitric oxide it has been proposed as adjuvant of mammography, aiming to detect early functional breast anomalies. We have reported a case in which abnormal breast thermography showed a high level of metabolic activity in the internal upper quadrant of the left breast. Along with the physical exam it contributed to increase the sensibility of the previously mammographic BI-RADS 3 (defined as probably benign findings) anticipating in at least six months a "core biopsy" procedure request. This biopsy resulted in the diagnosis of an invasive ductal carcinoma, i.e., months before it was expected. In this particular case, infrared thermography was crucial to the correct referral of the patient, helping in the early breast cancer diagnosis, widening the options of treatment and improving the prognosis of this patient.

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ACUPUNTURE INDUCED THERMOGRAPHIC ALTERATIONS

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Acupuncture is a kind of treatment based on the principle of opposites Yin / Yang - Hot / Cold that involves inserting fine needles into points on the human body, previously identified by cartographic maps thousands of years old. The point location process uses anatomical landmarks and the distance unit tsun. Among the studied physical properties of these points, there are the variation of electrical conductance, the cytological and microcirculatory uniqueness and the recently thermographic findings. Our body shows an interior to exterior continuous flow of energy. Uemastu in 1988 established that the average thermal variation between symmetrical areas is 0.24 ± 0.073°C, consequently, points with of thermal deviation above to that mentioned can mean stagnation of heat flow. Acupuncture induces local effects such as the release of histamine and nitric oxide secretion of serotonin, β-endorphin and remote effects such as the release of spinal dynorphin and brain changes according sting area. Infrared Thermography (IT) in these areas show a primary response that behaves according to the zeroth law of thermodynamics: "If two bodies are in thermal equilibrium with a third, then they are in thermal equilibrium with each other." The heat flows from warmer to cooler until all are at the same temperature. Post-acupuncture late IT´s can show cooling of hotter areas and heating of cooler areas tending to temperature balance with the surroundings. This behavior suggests that IT could be used to locate points of obstruction to the flow of heat (energy), to monitor the response to needling, as well as to follow the evolution of the treated areas until it reaches a difference below that found by Uematsu and even as a dis- charge criteria.

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MEDICAL EXPERT THERMOGRAPHY EXAMINATION

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The authors describe a medical expert examination case involving a 51 year old plaintiff related to industry labor demand. He came to the clinical expert medical evaluation with medical reports with the following diagnoses that started after only two months of work: bilateral subacromial bursitis, Thoracic Outlet Syndrome, Shoulder Impingement Syndrome and Tunnel Carpal Syndrome also associated with right supraspeinatus tendinitis. However his physical claims were not compatible with the expert physical examination. The forensic examination concluded to be a Fibromyalgia Syndrome that was confirmed and documented by thermography performed during the evaluation in the same time. The medical expert must get results closer to the truth, and the thermographic examination performed in our case was of great value to the establishment of no link between the alleged diseases and work. So there was concluded no causal nexus in this labor demand. The authors emphasize that thermographic examination must be performed in ideal conditions, according to the international protocols to be analyzed in the forensic legal field.

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MEDICAL THERMOGRAPHY FOR THE DIAGNOSIS OF FIBROMYALGIA SYNDROME AND EXCLUSION OF OTHER WIDESPREAD PAIN DISORDERS.

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Currently there are no laboratory tests available for diagnosing fibromyalgia (FM). Doctors must rely on patient histories, self-reported symptoms, a physical examination and an accurate manual tender point examination. This exam is based on the standardized American College of Rheumatology (ACR) criteria. To be used as a complementary diagnosis of FM syndrome, thermography must exclude other widespread pain disorders. The authors present a FM case report to discuss it.

PROCEDURE: Initially the patient stayed standing and undressed for 15 minutes to equalize full body temperature in a conditioned environment at 23° C and air humidity below 60%.

RESULT: The FM patient showed a well-defined warmer image on the trunk area like a mantle shape caused by thermo- regulation disorder simultaneous with cold extremities triggered by peripheral vasoconstriction and also periocular heating, known as "owl eye" essentially due to related sleep disorders.

DISCUSSION: It is estimated that it takes an average of five years for an FM patient to get an accurate diagnosis. Many

doctors are still not adequately informed or educated about FM. Laboratory tests often prove negative and many FM symptoms overlap with those of other conditions, thus leading to extensive investigative costs and frustration for both the doctor and patient. Another essential point that must be considered is that the presence of other diseases, such as rheumatoid arthritis or lupus, does not rule out an FM diagnosis. FM is rich of neurovegetative symptoms and impairments that are not related to other widespread pain disorders. FM is not a diagnosis of exclusion and must be diagnosed by its own characteristic features, especially by the neurovegetative impairments that can be documented by thermography. FM test must be focus on these neurovegetative disturbances.

CONCLUSION: If associated with clinical assessment thermography can be effective in further documentation diagnosis of fibromyalgia syndrome, and also for the exclusion diagnosis of other widespread pain disorders.

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THERMOMETRY SKIN IN THE DIAGNOSIS OF CHRONIC CHEST PAIN - A CASE REPORT

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INTRODUCTION: Chest pain is a prevalent and worrisome symptom, whose research and treatment involves a high cost. At the end of their investigation approximately two thirds of the patients are confirmed with noncardiac chest pain origin (DTNC), but these patients still remain consulting experts, conducting admissions and procedures in search of the solution, but this has been raising the cost associated with such events. JCFS, 46 years old, male, mechanic with a history of widespread pain for 6 years, poorly characterized, more intense in the precordial region (VAS = 7/10), occipital and right buttock radiating to the right lower limb. He denied other diseases, smoking and alcohol. He is a breadwinner and judges himself anxious. On examination showed myofascial trigger points in trapezius and right gluteus medius, pain to palpation in the lumbar paraspinal region and negative Laségue test when straight bilaterally.

DISCUSSION: Costochondritis, pleurisy, gastroesophageal reflux and myofascial pain are part of the differential diagnosis of DTNC and they require multiple tests for diagnosis. The investigation of pain in these patients include simple examinations up to more complex exams such as magnetic resonance imaging (MRI) of the spine, stress testing, myocardial scintigraphy and cardiac catheterization. In our case only lumbar MRI showed some unspecific changes, as L4L5 and L5S1 disc protrusions. It was conducted full body thermography, which showed the "mantle sign" as a supraclavicular and face hyper radiation with isothermal distribution associated with thermal signatures of myofascial dysfunction in projection of sternocleidomastoid, trapezius, gluteus medius, masseter, temporal muscles and right paravertebral contracture. The thermographic diagnosis guided the treatment with dry needling, acupuncture and global postural reeducation (GPR), with 80% resolution of the chest pain.

CONCLUSION: Being a non-invasive and easily applicable method, thermography can help to reduce the cost and time of diagnosis and treatment of chronic non-cardiogenic chest pain.

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POST-LAMINECTOMY SYNDROME: PRESENTATION OF A CLINICAL CASE EVALUATED BY THERMOGRAPHY

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INTRODUCTION: Post-laminectomy syndrome, also called failed back surgery syndrome, is a clinical condition characterized by low back pain of unknown origin that persists or starts after surgical interventions performed to treat lumbar disc herniation (HDL). It may or may not be associated with radiated or referred pain (IASP, 2003). This lesion was initially described by Mixter & Barr (1934) who correlated the clinical findings of disc herniation with prolapse of nucleus pulposus and proposed laminectomy as one surgical solution. The reported prevalence is from 5 to 50% of laminectomy cases (Chrobok et al., 2005; Tommasi et al., 2004) with the main causes being associated to preoperative factors (misdiagnosis, inappropriate patients), intraoperative factors (inappropriate or improper selection and execution of the surgical technique) and factors unrelated to surgery (change of mood, labor dispute) (Mannion & Elfering, 2006; Filler et al., 2005). The clinical picture is characterized by disabling back pain and nonspecific clinical findings with the presence of myofascial and neuropathic pain (Burton, 1985; Dvorak et al., 1988; Hedtmann, 1992).

CLINICAL CASE: The case of a 64-year-old female Caucasian farm worker is reported. This patient reported a strong low back pain without irradiation on physical effort during her work. She required a specialized Neurosurgery service where was treated for three months without improvement of the symptoms. She didn´t remember the drugs prescribed at that time but remembered that she had intensive pain (visual analogue scale - VAS: 8). A lumbar MRI was performed after clinical treatment which identified disc herniation. The patient was admitted to a charity hospital and underwent surgery to remove the hernia and L5-S1 arthrodesis was performed. The patient awoke from the surgery without pain, but after approximately one month she was re-operated to treat a infectious process at the site of the first surgery, without exchanging the synthesis material. The patient reported that in the immediate post-operative period of the second surgery she had strong lower back pain with irradiation to the thigh and right leg (VAS: 10) but without pain in the right foot. She remained hospitalized for 15 days receiving morphine. At discharge the infectious process had regressed and started rehabilitation with physiotherapy twice a week. But there had not been any improvement in the pain when she was referred to the Chronic Pain Treatment Clinic of the University Hospital in São

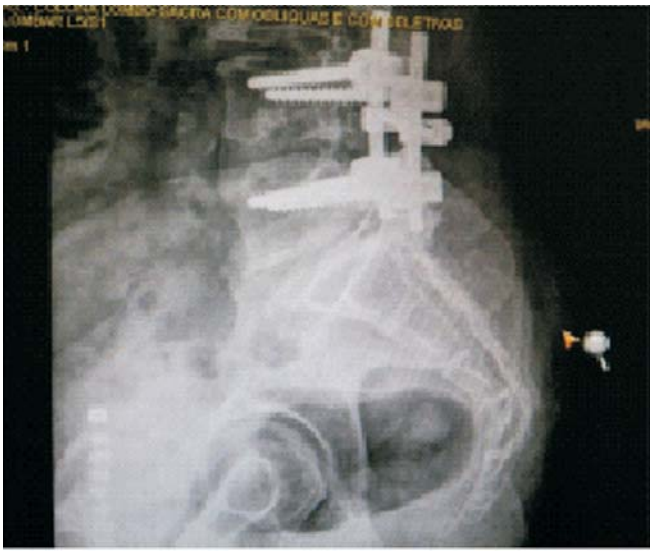

Figure 1
Radiograph of the lower lumbar spine, lateral view

Figure 1
Radiograph of the lower lumbar spine, anterior-posterior view

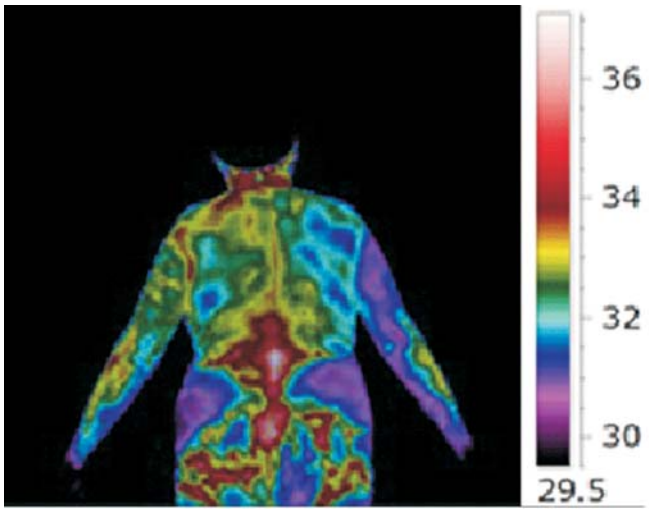

Figure 3
Thermographic image

José do Rio Preto, São Paulo, Brazil, where she was treated by a multidisciplinary team consisting of doctors, physiotherapists, psychologists, occupational therapists, a nutritionist, nurses and social workers.

PHYSICAL EXAMINATION: The patient was in a good nutritional general state, hydrated, conscious, oriented and obese. The posture of the patient was affected with internalization of the trunk; she walked only with the aid of a walking stick in her left hand. Amplitude of movement of the hips, knees and feet was preserved for age. The driving force of the quadriceps muscle was slightly reduced (she reported pain during the test), surface pain sensitivity was preserved, myotatic reflex was present but diminished in both lower limbs and Lasegue's test proved negative bilaterally. Pain intensity by the VAS was 8 while standing or walking; this improved on sitting. With this clinical picture, the patient was medicated with Omeprazole, Amitriptyline (50mg /day), Baclofen (10 mg VO b.i.d.) and Metadon (5mg t.i.d.) but no significant improvement in the pain was observed (VAS: 7).

IMAGING EXAMS: An X-ray showed L5-S1 arthrodesis with pedicle screws and sacroiliac arthrosis (figures 1 and 2).

Magnetic resonance was not performed due to technical difficulties. Thus a medical thermography examination was requested and the thermographic image was compatible with an entrapment of the L5 nerve root (fig. 3)

After the examination, the patient was prescribed gabapentin (1800 mg/day) with significant improvement in the pain (VAS: 8 - strong pain to VAS: 5 - mild/moderate pain). The patient managed to restart physiotherapeutic rehabilitation sessions.

CONCLUSION: Thermography contributed to the diagnosis and led to changes in the prescribed medications as the results demonstrated radicular impairment which has not been clear in the clinical neurological examination.

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CASE REPORT: MYOFASCIAL PAIN SYNDROME IN PATIENT WITH NEUROMUSCULAR SCOLIOSIS - USE OF THERMOGRAPHY IN DIAGNOSTIC AND THERAPY EVALUATION

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Myofascial pain syndrome is one of the most common causes of pain. Usually related to trauma, recurrent microtrauma or postural overload is a highly prevalent pathology, leading to high social and economic impact. Despite its prevalence, it is frequently not recognized, since the diagnosis depends on a detailed medical history and precise physical examination. Even when suspected, differential diagnosis and the precise location of the injured tissues may be difficult, compromising treatment efficacy. The use of Thermography, associated to a careful physical examination, provides better diagnosis and therapy directions. We report a case of a young patient, with neuromuscular scoliosis related to myelomeningocele, in chronic cervical, lumbar and leg pain, besides headache. We performed a Thermographic evaluation, identifying myofascial compromised areas related to postural overload. Based on images and clinical information, patient was treated and showed great pain and posture improvement.

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CASE REPORT: THERMOGRAPHY AND PERIPHERAL VASCULAR DISEASE

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Streptococcal erysipelas or lymphangitis is a bacterial infection of the papillary layer of the dermis extending into the superficial lymphatics. The etiologic agents may be exogenous or own flora, which penetrate the skin through some skin continuity solution. Currently has a good prognosis due to the use of antibiotics. A variant known as bullous erysipelas reveals a more severe form of the disease.

Peripheral arterial disease is a common circulatory problem among patients from 50 to 75 years old, with the potential to indicate limb amputation or even death risk for the patient. It is characterized by inadequate tissue perfusion and atherosclerosis is the most frequent cause. It shows a direct correlation with smoking.

Here we present a case report of a 65- year-old heavy smoker with bullous erysipelas and asymptomatic peripheral arterial disease, treated appropriately with antibiotics in a hospital and who developed a quite slow recovery and necrosis of the epidermis. This patient was referred for vascular evaluation in order to determine the viability of the member and if necessary the level determination of a surgical amputation.

Surprisingly the infrared thermogram in this case demonstrated viability of the limb and the patient was referred for endovascular treatment with stent placement and therapy in a hyperbaric chamber.

The digital thermography is non- invasive, safe and reproducible diagnostic method without the use of radioactive contrast and it can be used as an adjunct to vascular evaluation.

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AN INFRARED IMAGING CASE STUDY: FACIAL PAIN CAUSED BY PULPITIS

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INTRODUCTION: Orofacial pain has odontogenic source as one of the most frequent causes. It is common to use X-ray examinations that emits high energetic, ionizing radiation. Thermographic devices do not emit radiation and direct contact with the affected area is no longer required.

CASE DESCRIPTION: BFA, male, 34 years old, complains of pain in the right anterior hemiface for 3 years. He mentions having undergone dental treatment for an abscess with a fistula in his upper right first molar. There was a period without pain but later the symptoms returned. Thermographic image was captured from the front face incidence, as preliminary procedure. The image showed the asymmetry of the face with standard thermal hyper-radiation in the zygomatic region. The patient was referred to the dentist who confirmed the diagnosis of pulpitis and the new therapeutic approach was settled.

DISCUSSION: The hyper-radiation identified in the thermographic image reveals an area with metabolically active and significant change (measured delta T:0.8 °C, by 0.25 °C higher than the normal value). Due to this thermographic examination, the patient was spared from exposure to harmful electromagnetic radiations, was preserved from tests that could worsen painful symptoms, assessed the patient's pain, helped in the treatment decisions and helped to prevent the development of complications in pulpitis.

CONCLUSION: Thermography is a non-invasive, non- traumatic examination that is decisive for the diagnosis, therapeutic management and good prognosis in orofacial pain.

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CHRONIC PAIN IN LEFT HAND AFTER TRAUMA IDENTIFIED BY THERMOGRAPHY

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December 2012 a 19 years old woman had work related accident caused by gripping the left hand between mechanical structures in a fridge industry, with fracture of 5th finger distal phalanx. She was managed with an uneventfully conservative treatment. Later the resignation, eight months after the accident, she filed a labor indemnity claim and was attended by an expert examination in November 2013 with intermittent pain complaints of the left hand, referring swelling and difficulty for bending the fingers. The medical expert physical examination didn´t identify any functional limitations. Thermographic images were taken in ideal

condition for examination and identified hyporadiants thermal images on the left hand suggesting a possible sequel to the accident. The infrared imaging identified anomalies that justified the complaints of pain she had alleged during the medical expert examination.

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THERMOGUIDED TRIGEMINAL NEURALGIA SURGERY

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BACKGROUND: Trigeminal neuralgia is a neuropathic disorder of the trigeminal nerve with paroxysmal attacks of severe pain lasting from a fraction of a second to minutes, affecting one or more divisions of the trigeminal nerve, and the maxillary branch V2 is the most frequent reached. Pain has at least one of the following: intense, sudden, superficial, precipitated by factors trigger or trigger areas as a light touch or small movements, talking, drinking, brushing teeth, shaving, chewing. Infrared thermography is an examination without contrast or radiation with a thermal camera that features high sensitivity sensors which allows obtaining high resolution images that are studied using specific software and identifying possible changes in temperature characteristics of neurovascular disorders.

OBJECTIVES: To demonstrate the use of thermography as a tool for diagnosis of Trigeminal Neuralgia and surgical monitoring parameters for analysis result of retrogasserian compression by balloon pre, intra and postoperative complementary to clinical symptoms.

METHOD: Female patient 78 years with severe pain (VAS 8-10) in the right maxillary region, began three months ago with a gradual worsening crises and recurrent shocks triggered by the act of mastication, direct contact and cold on the face. She underwent retrogasserian compression by balloon due persistence of pain and adverse reactions to medications and the phases of treatment were evaluated by thermography.

RESULTS: Preoperative thermography showed temperature difference (Delta-dt) of 1.1oC in the affected right face area compared with the opposite non painful side. Intraoperative examination have revealed an increase of 0.6oC after compression of the Gasserian ganglion in its area of referred pain and hyper-radiation in the territory of V1 and V2 (predominant) which signaled to the surgeon that he had achieved its objective, the neuropraxis of maxillary branch of trigeminal nerve. Reassessment of the patient on the 10th postoperative day confirmed the clinical improvement (VAS=0) and showed symmetrical thermographic pattern of the face without temperature difference in the analyzed areas.

CONCLUSION: Thermography is a harmless test that can be used to establish the Trigeminal Neuralgia, to assist the surgical procedure and to control the postoperative response because it determines the temperature variation due neurovascular reaction.

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THERMOGRAPHY CASE REPORT: NEUROPATHIC CENTRAL PAIN

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E.C.L. 68 years old with right neck pain and hoarseness for about 20 years. At clinical exam was found myofascial trigger points in the right upper trapezius. The aphonia started after the end of her marriage. The patient was previously singer and wants to continue their vocal classes. The full body thermography helped to additional clinical diagnoses as right shoulder perintendinitis, contracture of the left posterior cervical muscles (osteoarthropathy), dysfunction of temporomandibular joint, L4 and C5 right radiculopathy and sleep disorders (periocular hot spot). But especially two finds were essential in this case: signs of vascular insufficiency in the internal carotid in the face territory (delta T 0.5o C) associated with a noteworthy asymmetry of the whole body compatible with neurogenic central pattern. After thermographic examination, the patient went to the neurologist who indicated a brain MRI. Despite the absence of a significant finding in MRI an ENT doctor found asymmetric vocal cords. Today she is taking the gabapentin 300mg a day, doing therapy with a speech therapist and singing. Her voice is better and there is a considerable improvement after the thermography identification of her neurologic problem.

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CUTANEOUS INFRARED THERMOGRAPHY AND ITS APPLICABILITY IN CHRONIC PAIN ORIGINATING IN THE ABDOMINAL WALL AFTER LAPAROTOMY AND HERNIOPLASTIAS (INGUINODINIA): CASES REPORT.

Vitor Hugo da Silveira Ferrão MD, Marcos Leal Brioschi MD, Manoel Jacobsen Teixeira MD

Clinical Thermology and Thermography Postgraduate Specialty Hospital das Clinicas, University of São Paulo Medical School, São Paulo, Brazil.

The diagnosis of abdominal pain of chronic nature, that has the origin in the abdominal wall, is in many cases difficult to solve and also is generator of concern, limitations and conflicts, which need sometimes multidisciplinary approaches. This work will report two cases of hernia repair and it will be done by focusing on pain related to inguinal, which until 10% of these have reports of pain complaints, but very common in pelvic surgery and the

lumbar access. Not infrequently, patients are submitted to do expensive examinations and invasive procedures, such as colonoscopies, videolaparoscopies and imaging. Also, they are referred to psychiatric evaluations. Surgical techniques and proper care during surgery as well as more careful indication of the use of prostheses provide the reducing of incidence in these situations. Becomes imperative clinical differentiation between somatic and neuropathic lesions frames because it may define the best approach. The objective of this presentation is to show the applicability of thermography for diagnostic conduction and therapeutic development in patients with complaints of post surgical inguinodinia.

Reference

Brioschi ML, Silva FMRM, França GV, Teixeira MJ. Termografia no diagnóstico da dor. In: Onofre Alves Neto, Carlos Maurício de Castro Costa, José Tadeu T. de Siqueira, Manoel Jacobsen Teixeira (SBED), organizadores. Dor: princípios e prática. Porto Alegre: Artmed; 2009, v. 1, p. 1338-57.

APPLICABILITY OF INFRARED THERMOGRAPHY IN MEDICAL EXPERTISE

William Camilo Rodrigues Barrera MD, Marcos Leal Brioschi MD, Manoel Jacobsen Teixeira MD

Clinical Thermology and Thermography Postgraduate Specialty Hospital das Clinicas, University of São Paulo Medical School, São Paulo, Brazil.

The disabling pain when not related to a visible trauma or pathology that recognized the triggers becomes a subjective complaint difficult to be measured and therefore can hind a favorable expert report for the plaintiff. Infrared thermography allows an evaluation of microcirculation and neurovegetative small nerve fibers, anatomical structures that change the skin temperature in the presence of inflammation disturbs that cause pain and discomfort, and thus can be a useful tool to the medical expertise. The objective of this work is to show the applicability of thermography in patients with severe pain and limited mobility submitted to medical expertise, but without laboratory tests and images to justify the cause of pain. The methodology was qualitative in nature, through a case study of a 44 years old male, complaining of pain in the lower limbs and with difficulty to walk, the VAS intensity was 10. He has a past history of brain stroke with minimal apparent outcome, but without laboratory tests to confirm the cause of his pain. Thermography was conclusive to elucidate the central neurogenic pain. It showed that the patient has a generalized full body asymmetry related to the widespread pain and his disabling limitations to the work activities. We hope that this study contributes the medical expert to substantiate their reports by thermography allowing patients a diagnosis to ensure or not only social benefits, but also an effective treatment to relieve the pain.

Reference

Brioschi ML, Teixeira MJ, Silva FMRM, Colman D. Medical thermography textbook: principles and applications. Sao Paulo, Brazil:Ed. Andreoli; 2010.p.1-280.

Hubbard JE, Hoyt C. Pain evaluation in 805 studies by infrared imaging. Thermology. 1986;1:161-6.

Brioschi ML, Okimoto ML, Vargas JV. The utilization of infrared imaging for occupational disease study in industrial work. Work. 2012 Jan 1;41(0):503-9.

Brioschi ML, Cherem AJ, Ruiz RC, Sardá Júnior JJ, Silva FMRM. The use of infrared thermography in evaluating returns to work in an extended rehabilitation program (PRA). Acta Fisiatr 2009; 16(2): 87-92.

Meetings

4th-6th April 2014

XVIII National Congress of the Polish Association of Thermology in Zakopane, Poland

Further information: see page 25

10th - 14thApril 2014

Veterinary Thermal Imaging

The course is given by Dr. Tracy Turner, USA

Information:
Irma Wensink
De Leegte 16,
8162 BZ Epe, The Netherlands

email: irma@thermografie-centrum.nl
www.thermografie-centrum.nl

5th - 9th May 2014

Thermosense XXXVI, Baltimore Convention Center; Baltimore, Maryland United States

TOPICS

Aerospace Applications

Automotive Industry

Building Applications

Environmental and Agricultural Monitoring

Food Processing

Infrastructure

IR Image Fusion Applications

- biological and medical
- field security
- process monitoring
- structural analysis.

Manufacturing and Processing Industries

Materials Evaluation and NDT

Medical

- breast cancer screening
- veterinary applications
- human and animal application.

Miscellaneous

- resource and maintenance management
- economic impact, justifications studies
- equipment, software, and practices guides
- professionalism, standards, and certification.

NDT (Nondestructive Testing)

Power Generation and Distribution (Electric)

Research and Development

- enhanced spatial resolution
- enhanced time resolution
- image interpretation
- medical applications
- microscopy
- new methodologies
- thermal modeling, CFD and FEA.

Security

- disease screening
- fire and rescue
- law enforcement
- surveillance in civilian applications.

Further information
Herbert Kaplan hkaplan@earthlink.net
or Andres Rozlosnik aer@termografia.com

http://thermosense.org/2013/cfp-thermosense-xxxvi/

11th-12th June 2014

MeMeA2014 - 9th edition of IEEE International Symposium on Medical Measurement and Applications in Lisbon, Portugal

Special session on
"Developments and Applications of Thermography"

Organizers:
Joaquim Gabriel, Faculty of Engineering,University of Porto, Portugal, jgabriel@fe.up.pt
Ricardo Vardasca, Faculty of Engineering, University of Porto, Portugal, ricardo.vardasca@fe.up.pt

Http://memea2014.ieee-ims.org,

7th-11th July 2014

12th Quantitative InfraRed Thermography Conference, QIRT 2014 in Bordeaux, France

Further information: see page 26

14th- 16th July 2014

10th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics in Orlando, Florida,

Venue: Hyatt Regency Grand Cypress Hotel, USA, One Grand Cypress Blvd, Orlando, Florida, FL32836

Purpose: The conference is broad in scope and provides a forum for specialists in heat transfer, fluid mechanics and thermo- dynamics from all corners of the globe to present the latest progress and developments in the field. The broad scope brings together a wide range of research areas from narrow funda- mental work to import applications such as in the broad fields of energy, manufacturing, biomedical, processes, production, education, instrumentation and control, MEMS, etc. This will not only allow the dissemination of the state of the art, but it will serve as a catalyst for discussions on future directions and priorities in these areas. The additional purpose of this conference is to initiate collaboration in research.
I*nformation:* http://edas.info/web/hefat2014/home.html

11th-12th August 2014

International Conference on Heat Transfer and Fluid Flow (HTFF'14) in Prague, Czech Republic

Information: info@HTFFconference.com

13th - 14th September 2014

Kinesiology and Thermography, in Epe, the Netherlands

The course given by Prof. Dr. med. Marcos Brioschi, Brazil

Sign Up before 10thAugust.

Information:
Irma Wensink
De Leegte 16, 8162 BZ Epe, The Netherlands
email: irma@thermografie-centrum.nl
www.thermografie-centrum.nl

September 15th, 2014

The use of Thermography in Rheumatology.

The course given by Prof. Dr. med. Marcos Brioschi, Brazil

Sign Up before 10thAugust.

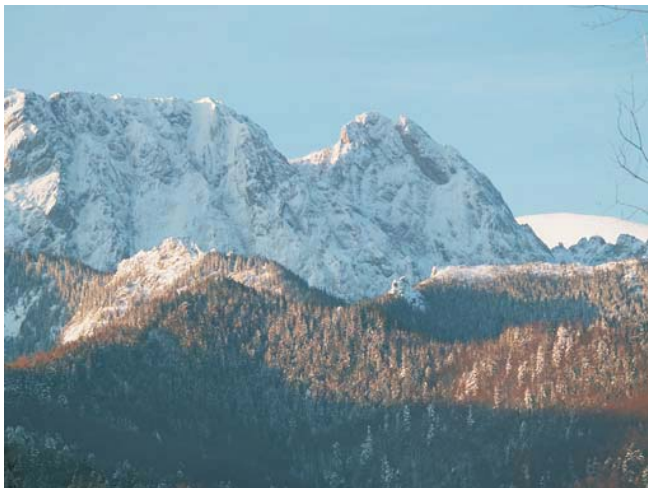
Information:
Irma Wensink
De Leegte 16, 8162 BZ Epe, The Netherlands
email: irma@thermografie-centrum.nl
www.thermografie-centrum.nl

26th-28thSeptember 2014

ThermoMed International 2014, 60th Anniversary of the German Society of Thermography and Regulation Medicine, in Langen near Frankfurt

A website for the conference will be online from September 2013 at (www.thermomed.org)

Please send all abstract in parallel to reinhold.berz@gmx.de and to sauer@hsauer.de.



XVIII NATIONAL CONGRESS OF THE POLISH ASSOCIATION OF THERMOLOGY

ZAKOPANE 4th-6th April 2014

GENERAL INFORMATION

REGISTRATION FEE: 250.- €

ABSTRACT DEADLINE February 15th 2014

ajung@wim.mil.pl or a.jung@spencer.com.pl

Abstract form will be published in Thermology International and in Acta Bio-Optica et Informatica Medica and registration on line

Professor Jung and the Organizing Committee invite you to this annual conference in the beautiful mountain resort of Zakopane in South Poland, which is 2hours journey by bus from Krakow International airport and the city of Krakow. The conference is in HYRNY Hotel with its wonderful views of the Tatra mountains, and short walk from the town centre.

Local Organizing Committee

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Dr Janusz Zuber (Deputy Chair)
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Agnieszka Rustecka

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Prof Adriana Nica MD,PhD (Romania)

Registration fee for non Polish participants will be paid in cash on arrival at the conference.
Registration by e-mail is required before March 1st to ensure hotel reservation.
After registration number is issued, delegates are committed to payment of the fee.

Registration includes welcome dinner Friday 15th
Lunch and accomodation.
Extra night + breakfast + 70 €
Accompaning person – 200 €

Since 1992, the Quantitative InfraRed Thermography (QIRT) conference is a biannual international forum which brings together specialists from industry and academia, who share an active interest in the latest developments of science, experimental practices and instrumentation, related to IR thermography.

Following conferences in Paris (1992), Sorrento (1994), Stuttgart (1996), Lodz (1998), Reims (2000), Dubrovnik (2002),Brussels (2004), Padova (2006), Krakow (2008), Québec City (2010) and Naples (2012), the 12th Quantitative InfraRed Thermography Conference, QIRT 2014, will take place on July 7-11, 2014, at the Mechanics & Engineering Institute of Bordeaux.

QIRT 2014 will cover, but will not be limited to, the following topics:

• State of the art and evolution in the field of IR scanners and imaging systems allowing quantitative measurements and related data acquisition and processing.

• Integration of thermographic systems and multispectral analysis. Related problems such as calibration and characterization of IR cameras, emissivity determination, absorption in media, spurious radiations, 3D measurements, certification and standardization.

• Thermal effects induced e.g. by electromagnetic fields, elastic waves or mechanical stresses.

• Application of IR thermography to radiometry, thermometry and physical parameters identification in all fields such as: industrial processes, material sciences, thermo-fluid dynamics, energetics, non- destructive evaluation, cultural heritage, environment, medicine, biomedical science, food production…

Important dates

• Abstract submission deadline: January 15, 2014
• Acceptance notification: February 15, 2014
• Paper submission deadline: April 30, 2014

Abstract and Paper Submission

The participants are invited to submit to the QIRT 2014 Web Site (qirt2014.scientificevent. com) by January 15, 2014 an extended abstract of 2 pages (letter size A4 format), either for oral or poster presentation, including key figures and main results. A book of abstracts will be distributed at the conference.

Following acceptance notification, camera ready, full paper of 6-10 pages including color figures should be submitted to the QIRT 2014 web site by April 30th, 2014. All submissions for oral or poster presentation will be handled electronically via the conference website QIRT2014.scientific-event.com.

A Word template to be used for both abstracts and full papers is downloadable at the website. Authors are requested to propose the thematic section in which the paper should be included.

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Tutorials, Technical Visit and Workshop

QIRT short courses

In addition to the main technical program, the conference will include one-day short courses (Monday, July 7). The program and the related fees will be defined soon and presented in the conference website. It will include a general introduction to thermography in the morning and specialized courses on various application fields given in parallel during the afternoon (non-destructive evaluation, thermo- fluid-dynamics, building, thermomechanics…).

Summer course on thermomechanics

A summer-course (given in French) on thermography and thermomechanics of materials will take place from June 30 to July 4. The website will be opened and related to the QIRT conference site in October 2013.

Technical Visits

A lot of research teams are using IR thermography on the Bordeaux University Campus and will be opened for visits.

Student Award

Striving to stimulate young researchers, the organizing committee will award the best conference contribution presented and authored only by students.

Conference fees (VAT included)

Regular participants

- Early rate (deadline: May 20, 2014): (550 €)
- Late rate (deadline: June 27, 2014): (650 €)
- Desk registration rate: (800 €)

Students

- Early rate (deadline: May 20, 2014): (350€)
- Late rate (deadline: June 27, 2014): (450 €)

Fee covers: Book of abstracts, Conference USB Proceedings, Welcome reception, Conference dinner, 3 lunches and coffee breaks. Accommodation is not included.
For regular participants only, fee includes also a subscription to QIRT Journal for 2 years (standard personal subscription rate 100 €/year).

Accompanying persons

- Rate (deadline: June 27, 2014): (120€)

This amount includes the Welcome reception and Conference dinner.

Venue

QIRT 2014 will be held at the Ecole Nationale des Arts et Métiers located in the campus of the Bordeaux University, at 20 min by tram from the historic center of the City. Bordeaux is listed to the UNESCO world heritage. The city is exemplary thanks to the unity of its classical and neo-classical architecture (see www.bordeaux-tourisme.com).

A list of hotels will be given in the conference website. Booking of hotel is not assumed by the conference organization. For students only, low cost accommodations can be booked on the Bordeaux University campus.

Conference website

For further information please visit the site:
QIRT2014.scientific-event.com

or contact the organizing committee at:
QIRT2014@scientific-event.com

European Association of Thermology

Physical Activity and Sports Faculty (INEF). U.P.M.

XIII European Association of Thermology Congress

Thermology in Medicine:
Clinical Thermometry and Thermal imaging

FIRST ANNOUNCEMENT

www.europeanthermology.com

The EAT and the Faculty of Physical Activity and Sports Sciences (INEF) are has the pleasure of inviting you to participate in the XX EAT Congress in Madrid between the 3rd and 5th of September, 2015.

The target of this Congress is integrating professionals and researchers from different fields who are working daily with medical thermography, introducing the latest advances in infrared technology and the new applications arising from them.

The Congress will appeal not only to end users of medical thermography but also to researchers and developers. The congress will focus on free communications and posters in the areas of Human Applications, Animal Applications, and Engineering.

We look forward to seeing you in Madrid in September 2015.

Manuel Sillero Quintana.
Chairman of the Organizer committee.

James Mercer
President of the AET.

VENUE

The congress will take place at the Physical Activity and Sport Sciences Faculty (INEF Madrid) which belongs to the Technical University of Madrid (UPM) located in the University City of Madrid. It has an auditorium with 600 places and two conference rooms with seating for 140 and 120 persons and are fully equipped with modern audio-visual equipments

XIII EAT CONGRESS 3rd to 5th September 2015, Madrid.

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* Additional members pending confirmation.

SCIENTIFIC PROGRAM

From September 2014 the Congress will be open for abstract, free communications and posters submissions in the areas of Human Applications, Animal Applications, and Engineering.

At the same time a draft of the scientific program will be included in the "call for abstracts" announcement.

KEY DATES

September 2013. Publication of the First Announcement.

Late September 2014. Publication of the "Call for Abstracts" document.

10th October 2014. Opening of abstract submission and registration.

30th January 2015. Abstract submission deadline

27th March 2015. Acceptance notification to authors.

17th April. End of Early bird registration and deadline for presenting authors registration.

XIII EAT CONGRESS 3rd to 5th September 2015, Madrid.

REGISTRATION FEES (*)

	Early Registration (Until 17-4-15)	Late Registration (Until 31-7-15)	Last-minute Registration (After 31-7-15)
EAT MEMBER	300 €	360 €	400 €
New EAT member	350 €	410 €	450 €
Non-Member	400 €	460 €	510 €
Student (**)	150 €	200 €	240 €
Accompanying person	200 €	260 €	300 €

(*) Further information about the registration process will be provided in the "Call for abstracts" document.
(**) A certificate with ECTS credits will be provided by U.P.M.

TRAVEL INFORMATION

Madrid-Barajas Airport is a large international and domestic airport with frequent direct flights from many international destinations. There is a train service directly from Terminal 4 (T4) to Príncipie Pío Station (35 minutes, about 2.50 €), where the two official hotels are located. They are also metro and buses from the Airport to the city center (40-50 minutes, about 5-6 Euros). A taxi from the Airport could be another option but a little bit more expensive.

The radial structure high-speed train (AVE), regional trains and buses allow travel to Madrid from the most important cities of Spain. Furthermore, Madrid has an excellent underground system, a frequent bus network and many reasonably priced taxis for local transportation. We encourage our attendees to use the public transport.

ACCOMODATION

Many tourist will be visiting Madrid at the same time of the congress. For this reason, the organizers of the EAT Congress has negotiated a large number of hotel rooms at attractive rates in our two official hotels:

+ **Hotel Celuisma Florida Norte**** (100 rooms already reserved):
- 35.35 € (incl. 10% VAT) per person in double bed room including breakfast (buffet).
- 59.35 € (incl. 10% VAT) single room including breakfast (buffet).

+ **Hotel Acta Madford***** (Number of rooms and prices available by September 2014). Actual normal price is about 55 € per a single room including breakfast.

Both hotels are 25 minutes walking to the venue and 10 minutes walking to the city center, and they have a bus station in front of their main entrance. Further information for booking them at the special prices of the congress will be provided in the "Call for abstracts" document.

There are cheaper youth hostels and bed-and-breakfast in the city center. In the next announcement we will provide a list with the most convenient ones according to their location and conditions.

Publications on Thermology 1989 to 2012 - An electronic archive DVD

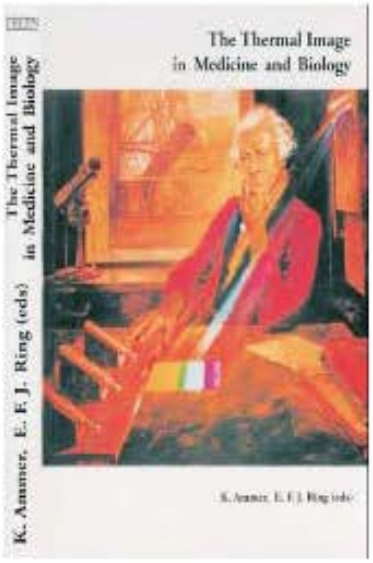
This data compilation contains all issues of

Thermologie Österreich
May 1991 to April 1997
European Journal of Thermology
July 1997to October 1998
Thermology international
January 1998 to October 2012

Plus

The Thermal Image in Medicine and Biology

edited by K.Ammer and E.FJ Ring
Uhlen Verlag, Wien (1995)



Plus

Published Papers on Thermology and Temperature Measurement

Volume 1: 1989 to 2004

Volume 2: 2005 to 2006

Volume 3: 2007 to 2011

Plus

Proceedings of the First Thermological Symposium of the Austrian Society of Thermology

Thermographie, evozierte Potentiale, edited by O.Rathkolb and K.Ammer

Plus

Proceedings of the Second Thermological Symposium of the Austrian Society of Thermology

Kontaktthermometrie und Thermographie, edited by K.Ammer and O.Rathkolb

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