

<https://doi.org/10.35630/2199-885X/2019/9/3.16>

## THE USE OF THERMOGRAPHY FOR DIAGNOSIS OF ACUTE APPENDICITIS

Alexey Sergeev , Artyom Morozov ,  
Evgeny Mokhov , Nikolay Sergeev 

Tver State Medical University, Tver, Russia

✉ [dr.nikolaevich@mail.ru](mailto:dr.nikolaevich@mail.ru)

**ABSTRACT** — A prospective controlled study was performed in 37 patients to check the capability of medical thermography. The method allows to capture infrared radiation and convert it into an image that records the heat distribution on the body surface. The method is not invasive and can be easily used in examining patients for the differential diagnosis of acute appendicitis in difficult cases.

**KEYWORDS** — medical thermography, acute appendicitis, diagnosis.

### INTRODUCTION

Up to 50% of patients are hospitalized with suspected acute appendicitis [1]. About 40% of all urgent surgeries are appendectomies. 4 to 35.5% of it are made wrongly [1, 2] and can lead to a high level of surgical site infections [3]. The main difficulty in the diagnosis of acute appendicitis is the absence of pathognomonic symptoms. One of the promising method for pre-operative examination is thermography. In some diseases thermography is characterized by a high reliability of diagnostics approaching [4, 5].

The purpose of the research was to study the possibilities of thermography in the diagnosis of acute appendicitis.

### MATERIALS AND METHODS

A prospective controlled study was performed. 37 patients with Acute appendicitis were examined. The male sex was the criterion for inclusion into the study group to exclude any diseases associated with the female reproductive system, as well as the absence of various chronic inflammatory processes in patients. All patients were diagnosed on the basis of a typical clinic of acute appendicitis and leukocytosis.

Patients were thermographed using a medical infrared imager “PERGAMED 640” with record and preservation of the results on an electronic carrier. The examination was carried out after preliminary preparation of the patient, which consisted of striping to the waist, after which the patient was forbidden touch

the area of examination (anterior abdominal wall) for 10 minutes, the room temperature while examination remained 20–22° C. The results of thermography were evaluated retrospectively after intraoperative diagnosis.

All the examined patients after diagnosis were divided into 3 groups: the 1<sup>st</sup> group included patients with intraoperatively diagnosed “Acute appendicitis”; the 2<sup>nd</sup> group — patients with intraoperatively diagnosis of “Acute mezadenitis”; and the 3<sup>rd</sup> group — patients with “Intestinal colic” (the diagnosis was put by exclusion after complete relief of the symptoms due to conservative measures).

### RESULTS AND DISCUSSIONS

Based on the correlation between clinical diagnosis and thermography data, it is the following: the thermograms obtained in the first observation group indicated evident changes in the right ileal region. In this region, there was a local temperature increase, clearly manifested in the form of a color patch, contrasting with intact tissues. All the thermograms determined a local increase in skin temperature in the right ileal region on average by 1–1.5° C. The average temperature of this thermographic phenomenon was 0.6° C in patients with catarrhal appendicitis, 1.58° C with phlegmonous appendicitis and 2.2° C in patients with gangrenous appendicitis respectively. The diagnosis of acute appendicitis was confirmed intraoperatively and morphologically in all patients in this group. Slight differences in the temperature characteristics of patients with different forms of acute appendicitis do not allow verifying these forms at the preoperative stage. For perhaps clearer visualization of the results, additional color palettes were used.

There are no characteristic changes in the thermographic pattern were detected during analyzing the thermograms obtained in the second and third groups (patients without appendicitis). The average temperature in all areas of the abdominal wall did not have any characteristic changes and was 34.5° C in patients with “Acute mezadenitis”, 34.2° C in patients with “Intestinal Colic” accordingly. All things considered, thermography allows you to differentiate the acute inflammatory process in the appendix from the not appendicular ones. For possibly clearer visualization of the results, additional color palettes were used.

The diagnosis of acute appendicitis is mainly based on clinical symptoms at present time. Thermog-

raphy as an objective method of clinical imaging can be complement the diagnostic process, especially in unclear clinical cases, relieving the patient of invasive diagnostic methods. The use of thermography for diagnosis of acute abdominal pathology is not widely used. Therefore, the further extensive research for possibilities of thermography in emergency surgery is needed.

## CONCLUSION

Medical thermography can be used as an additional method for acute appendicitis diagnosing, which makes it possible to diagnose correctly in complex cases. Pointing to the presence of inflammatory changes in the location of the appendix, thermography does not allow us to determine the shape of acute appendicitis. The use of medical thermography can significantly facilitate the differential diagnosis of acute appendicitis and other diseases of abdominal cavity.

## REFERENCES:

1. **DUBROVSKY A.V., KOVALEV A.I., PETROV D.YU., SMIRNOV A.V.** Sovremennye aspekty lecheniya ostrogo appendicita [Modern aspects of acute appendicitis treatment] // *Vestnik eksperimental'noy i klinicheskoy hirurgii* [Bulletin of Experimental and Clinical Surgery]. – 2013. – Volume 6. – No. 3. – p. 375–384. (in Russian)
2. **SOROKA A.K.** Laparoskopiya v provedenii klinicheskikh i morfologicheskikh paraleley appendektomiy [Laparoscopy in conducting clinical and morphological parallels of appendectomy] // *Endoskopicheskaya hirurgiya* [Endoscopic surgery]. – 2013. – No. 1. – p. 12–15. (in Russian)
3. **MOKHOV E.M., SERGEEV A.N.** Implantacionnaya antimikrobnaya prophilaktika infekcii oblasti khirurgicheskogo vmeshatel'stva [Implantation antimicrobial prevention of infection in the surgery intervention area] // *Sibirskoe medicinskoye obozrenie* [Siberian Medical Review]. – 2017. – No. 3 (105). p. 75–81. (in Russian)
4. **BICHINHO G.L., GARIBA M.A., SANCHES I.J., GAMBA H.R., CRUZ F.P.F., NOHAMA P.** A computer tool for the fusion and visualization of thermal and magnetic resonance images // *J. Digit. Imaging*. – 2009. – Vol. 22. – № 5. – P. 527–534.
5. **RING E.F.** The historical development of thermometry and thermal imaging in medicine // *J. Med. Eng. Technol.* – 2006. – Vol. 30. – № 4. – P. 192–198.