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Use of Infrared Thermography in Diagnosing Necrotizing Fasciitis in the Emergency Department: A Case Study

Mikkel Brabrand¹, Jan Dahlin¹, Marianne Fløjstrup², Stine Thorhauge Zwisler³, Jens Michelsen³, Louise Gramstrup Nielsen⁴, Jens Ahm Sørensen⁵

¹Department of Emergency Medicine, Odense University Hospital, Odense C, Denmark

²Department of Anesthesiology, Sygehus Lillebælt Hospital, Vejle, Denmark

³Department of Anesthesiology and Intensive Care, Odense University Hospital, Odense C, Denmark

⁴Department of Anesthesiology, Hospital of South West Jutland, Esbjerg, Denmark

⁵Department of Plastic Reconstructive Surgery, Odense University Hospital, Odense C, Denmark

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ABSTRACT

Objective: Necrotizing fasciitis is a difficult diagnosis with a very high mortality. However, thermal imaging has the potential to identify increasing skin temperature and rapid progression.

Materials and methods: We used repeat photographs taken with a thermal camera to visualize changes in skin temperature over time.

Results: An unstable male patient presented at the emergency department. Thermal imaging showed increased skin temperature of his left foot with a rapid increase and progression in extent within 1 hour. Necrotizing fasciitis was suspected and later confirmed.

Conclusions: We believe thermal imaging could be an important adjunct for the diagnosis of suspected necrotizing fasciitis.

LEARNING POINTS

- Necrotizing fasciitis is a difficult diagnosis to make.
- Thermal imaging can visualize skin temperature and thus show increased temperature and extent.
- Rapid identification of necrotizing fasciitis is vital for patient survival.

KEYWORDS

Necrotizing fasciitis, thermal imaging, diagnosis, septic shock

BACKGROUND

Many patients present to the emergency department (ED) with signs and symptoms of cutaneous and subcutaneous infection^[1]. Most have less severe infections, for example cellulitis or erysipelas, but a small fraction could potentially have much more severe conditions. Identifying these high-risk patients, for example those with necrotizing fasciitis, is difficult, relies on clinical findings and is usually confirmed during surgery^[2].

CASE PRESENTATION

The Emergency Medical Services (EMS) were called to attend a 75-year-old man who felt unwell and was confused after injuring his left foot on a tree branch 3 days previously. The EMS staff, realizing the patient was unstable and in a septic state, requested a physician staffed Mobile Emergency Care Unit (MECU). The MECU determined the patient's vital signs were normal apart from a body temperature of 39.5°C and a respiratory rate of 50 breaths per minute. On-site venous blood gas analysis revealed a blood lactate concentration of 5.7 mmol/l and a pH level of 7.3. Blood cultures were drawn and 2 g of meropenem were administered along with intravenous fluids.

Upon arrival at the ED, the patient's heart rate had increased to 114 bpm while his blood pressure remained normal. He was found to be slightly confused but scored 15 on the Glasgow Coma Scale. Arterial blood gas analysis showed a blood lactate concentration of 3.9 mmol/l and a pH level of 7.37. The patient desaturated and required supplemental nasal oxygen. Plasma creatinine was 182 mmol/l, bilirubin 22 mmol/l, C-reactive protein 127 mg/l, white blood cell count $2.51 \times 10^9/l$, and creatine kinase 773 U/l.

The patient's left foot showed marked evidence of a skin infection. The patient was found to have severe sepsis and incipient multiple organ failure, so antibiotics and intravenous fluids were intensified. Upon arrival at the ED, both conventional and thermographic images were taken with the patient's consent (Fig. 1a). Imaging repeated after 1 hour showed progression of the infection (Fig. 1b). Conventional imaging showed the development of bullae, while the thermal image showed increased dermal temperature and extent with decreased dermal temperature near the bullae.

The patient was taken to the operating theatre and the diagnosis of necrotizing fasciitis was confirmed. Blood cultures and tissue samples both showed growth of haemolytic group A streptococci.

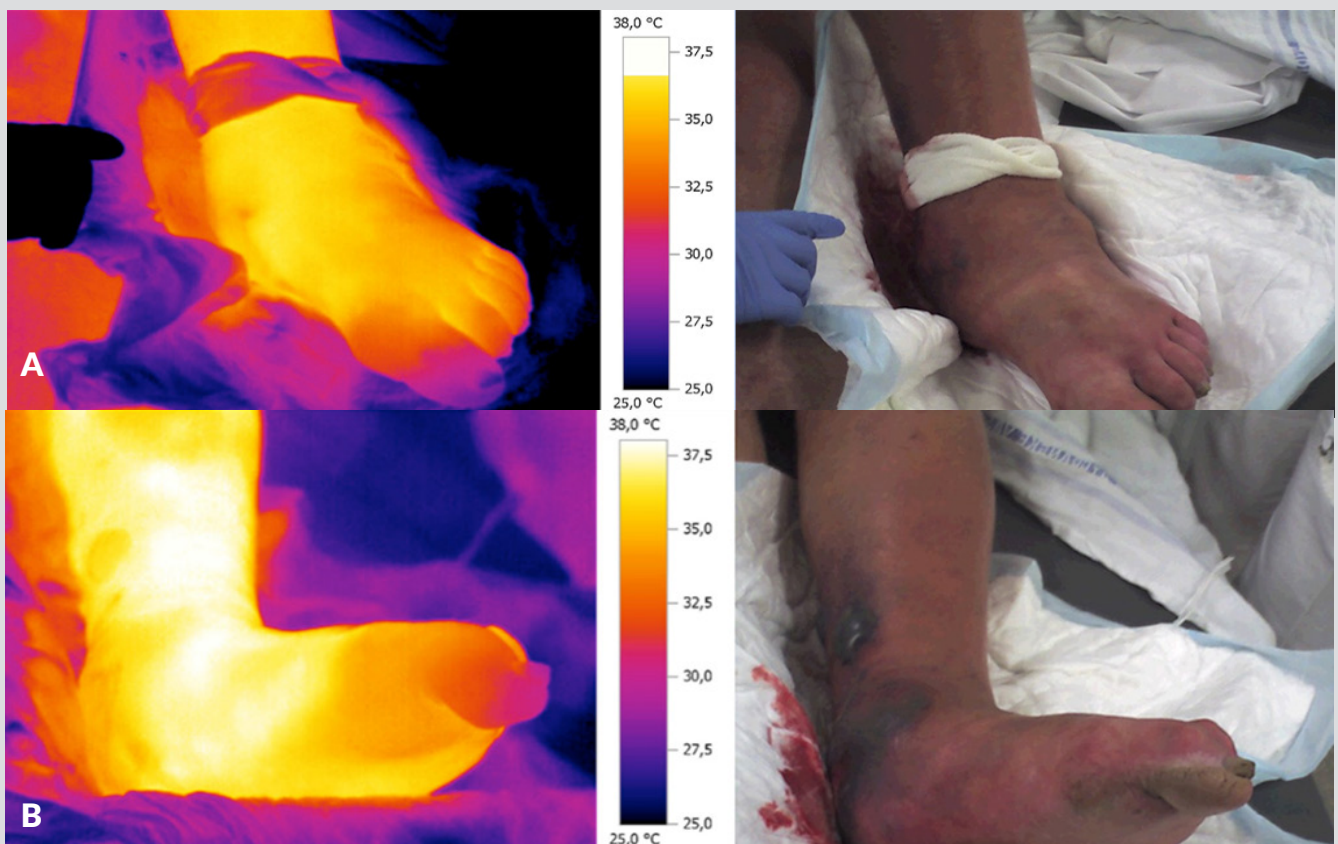


Figure 1 (a) Conventional and thermographic images on arrival when the warmest area at the ankle was 35°C.

(b) Conventional and thermographic images after 1 hour when, the warmest area at the ankle was 37°C, showing a distal decrease and proximal increase in surface temperature.

DISCUSSION

Thermography has been used very rarely in clinical medicine; the technique is primarily used in the industrial sector^[3]. However, thermography is extremely accurate at identifying differences in surface temperature and can therefore show increases in skin temperature, as in this case^[4]. Since necrotizing fasciitis is a challenging diagnosis to make and clinical observation is very difficult, we believe thermographic imaging could contribute significantly to making this diagnosis in the ED. To our knowledge, this is the first example of necrotising fasciitis diagnosed on the basis of thermographic imaging in the medical literature.

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