Thermocameras for Screening Travelers for Fever in the ED: A Pilot Study

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Abstract

Objectives: To test the feasibility of using thermocameras used in the detection of travelers with SARS, in the detection of patients with fever above 38ºC presenting to our Emergency Department (ED),at the Rambam Medical Center in Haifa.

Methods: We tested two kinds of infrared thermocameras in our ED - one with an internal calibrating system (camera I) and the other (camera II) had an external temperature reference.

Results: A total of 203 patients were tested. 19 (9.4%) of them were found to have fever (38-39.4ºC) by the nurse. 8 (42%) of those 19 patients were detected by camera I as having fever, while 11 patients were missed. 10(52%) of the 19 patients were detected by camera II, and 9 were missed.

Conclusions: Although the sensitivity of these cameras was low, we believe that the cameras passed a feasibility test: using these cameras may detect half of the passengers with fever, with a low false positive number of cases. As increasing the sensitivity of these cameras caused an increase in the false positive cases, camera performance needs to be refined to meet ED needs. A formal study with larger sample size is needed

MeSH Words: Thermocamera, Fever, Screening, Biosurveillance

Introduction

Many mechanisms have been proposed to explain the spread of new infectious epidemics (AIDS, EBOLA, SARS) [1]. These include the ease by which travelers move from one continent to another [2] and potential accidents occurring in genetic laboratories or in the development of biological weapons. Developing a device to detect infected patients coming from endemic areas is increasingly a priority.

With the spread of SARS, many countries started measuring the temperatures of travelers in airports, using the tympanic infrared thermometry, proved to be accurate compared to rectal temperature [3]. Other countries had used infrared thermocameras in airports to detect

Figure 1: Patients passed Camera II towards Camera I

travelers with fever among large masses of people. Few studies has been published regarding the sensitivity and specificity of such cameras.

The Israeli Ministry of Health sought to find a way to examine the sensitivity, specificity and feasibility of such cameras. The ED was identified as a location with large volumes of people, frequently with an elevated incidence of fever.

Objectives

To test the feasibility of using these cameras in the detection of patients with fever above 38ºC presenting to our Emergency Department at the Rambam Medical Center in Haifa.

Materials and Methods

We tested two kinds of infrared thermocameras in use internationally; one with an internal calibrating system (Camera I) and the other (Camera II) with an external temperature reference. (Contact author for camera model information). Camera I needs to be recalibrated daily with the aid of a computer, a procedure that takes about half an hour. Camera II has a fixed temperature reference, and needs to be tested from time to time with a glass filled with hot water to a temperature of 38 degrees.

Both cameras were situated in a stationary location where the effects of outdoor temperature and outdoor light were eliminated. The cameras were situated about 10 meters apart (See. Figure 1). Half of the time camera I was situated in the front and camera II in the back, and half the time vise versa. Each camera independently indicated if the patient's temperature was above 38 degrees or not.

Table. 1: Camera sensitivity and specificity

	Sensitivity	False Neg.	Specificity	False Positive	P value
Camera I	42%	58%	98%	2%	<0.001
Camera II	52%	48%	87.5%	12.5%	<0.001

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As demonstrated in figure 1, patients would pass camera II, which measured the patient's temperature from 0.5-meter distance on the side of the face (and the ear). If the patient's temperature was above 38 C, the camera emitted a visual and an audible signal. Camera I measured the patient's forehead temperature from a 3-meter distance continuously, until passing the camera.

Patients in the study passed in front of both cameras separately, and then had their oral temperatures measured by a registered nurse using a simple mercury thermometer. The results were collected and analyzed by a statistician from the Ministry of Health and our hospital. Chi square analysis was used for categorical variables.

Results:

A total of 203 patients were tested over the course of five shifts. 19 (9.4%) of them were found to have fever (38-39.4ºC) by the nurse. 8 (42%) of those 19 patients were detected by camera I as having fever, while 11 patients were missed. 10(52%) of the 19 patients were detected by camera II, and 9 were missed (see table no. 1).

We found no significant difference between the cameras in detecting patients with fever (P = 0.63), nor in specificity (P= 0.57).

Both cameras passed the test of feasibility (p<0.001), as they detected half of the patients with fever without a high false positive percentage.

When we increased the sensitivity of both cameras to detect all patients with fever, the percentage of the false positive cases increased to 25% for camera I, and to 30% for camera II.

Discussion

Concern regarding the spread of epidemics by international was heightened with the emergence of SARS.. In some countries, teams of nurses measured the temperatures of the passengers, a mission that is logistically impractical. For reasons of practicality, the application of thermocameras for screening large masses of people has attracted much attention.

Thermocameras have been used for this purpose in at least 18 countries worldwide. Chan et al from Hong Kong [4] found good correlation between measuring the temperature in the area of the ear by an infrared thermocamera, 0.5 meters far from the patient, to the temperature measured orally by a nurse. We did not find a good correlation between the results measured by the camera and those measured by the nurse separately, using camera II in a similar fashion .

Ng et al demonstrated that these cameras are more accurate when they were focused on the eye rather than on the ear[5].

W note several limitations to this study. The small sample size leads to results that are compelling but not conclusive. Also our results may not be generalizable to other cameras or settings.

We believe that these cameras passed a feasibility test i.e. if there is no other practical screening alternative, using these cameras can detect half of the passengers with fever, with a low false positive number of cases. However, the performance available at the time of writing was not sufficient to meet screening needs. As the same cameras that were tested were used in many countries worldwide, further refinement is necessary before they are relied upon as the sole method of screening.

References:

1. Shoenfeld Y, Shemer Y. Why viral (Sars, Ebola and Aids) now? Harefuah 142:324-325, 2003.

2. Liang W, Zhu Z,Guo J,Liu Z,Zohn W,Chin DP,Schucat A; Beijing SARS Expert Group. Severe acute respiratory syndrome, Beijing, 2003. Emerg Infect Dis. 2004 Jan,10(1):25-31

3. Lanham DM, Walker B, Klocke E, Jennings M: Accuracy of tympanic temperature readings in children under 6 years of age. Pediatr Nurs. 1999 Jan-Feb;25(1):39-42.

4. Chan LS, Cheung GT, Lauder IJ, Kumana CR, Lauder IJ. Screening for fever by remote-sensing infrared thermographic camera J Travel Med. 2004 Sep-Oct;11(5):273-9.

5. Ng EY, Kaw GJ, Chang WM. Analysis of IR thermal imager for mass blind fever screening. Microvasc Res. 2004 Sep;68(2):104-9.

6. Ng EY. Is thermal scanner losing its bite in mass screening of fever due to SARS? Med Phys. 2005 Jan;32(1):93-7.

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