

Infrared Thermography in Detecting Pressure Injury



Singapore Healthcare Management 2019

<u>Aloweni FAB¹</u>, Ang SY¹, Ng XP¹, Teo KY¹, Choh ACL¹, Goh IHQ¹, Lim SH¹ ¹Nursing Division, Singapore General Hospital

Introduction

Detecting and diagnosing early stage PIs or deep tissues pressure injury (DTPI) remains a challenge, especially among patients with darker skin tone. Infrared thermography (IRT) has been used to predict wound healing and PI outcomes.¹ However, little is known about the use of thermographic images to detect presence of early stages PI or suspected DTPI (intact skin) on heel and/or sacrum.

Results

- A total of 17 cases and 51 controls were recruited.
- Mean temperature difference in PI sites and non-injury sites of cases were significant (Table 3). Figure 3 shows thermal images of sacral PI

Aim

To explore the diagnostic capacity of using infrared thermography device in assessing skin temperature among Stage I pressure injuries and/or suspected deep tissue pressure injuries (DTPI) with intact skin

Methodology

Study sample

All hospitalised adult patients who had PI (Stage I) or suspected DTPI and fit the inclusion and exclusion criteria were recruited (Table 1).

Table 1: Inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
 Above 21 years old 	 Blisters, broken skin or wound over the sacral or heel area
 Case: patient with stage I or suspected DTPI on the sacral or heel (intact skin) Control: patient with no PI i.e. intact skin over sacral or heel 	 Medicated plaster placed over heel or sacral
	 Medically unstable Febrile patients Restless and uncooperative Patients with only one heel

- site vs non-PI site within same case patient. An elevated skin temperature was observed on PI site.
- Comparing cases to controls, mean difference in temperature was nonsignificant, even after adjusting for body temperature and ambient temperature (Table 3).

Table 3: Comparison within cases (n=17) and between controls (n=51)

Comparison within Cases (n=17	')			
	Mean (SD)	t	р	Mean difference (SD)
Temperature of PI sites (in °C)	31.14 (1.54)	2.485	0.024*	2.21 (3.66)
Temperature of non-injury	28.93			
sites (in ∘C)	(3.47)			
Comparison between PI sites of	Cases (n=17) a	nd non-ir	njury sites	of Controls (n=51)
	Mean (SD)	t	р	Mean difference (SD)
Temperature of non-injury sites (in °C)	30.08 (3.42)	1.15	0.29	1.06 (0.84)
Note: * <i>p</i> < 0.05	PI: Sacral		Non-PI: Sacral	

<u>Study design</u>

- Cross-sectional study
- Inpatient wards, Singapore General Hospital (SGH)
- March to April 2018
- 1 case matched to 3 controls (age group, gender, race and PI sites)
- Thermal images taken using portable CAT S60 Thermal Imaging Rugged Smartphone (Figure 1).
- Data collected from case and control patients:
- 1) Demographic data \rightarrow age, gender, BMI, skin tone (Figure 2)
- 2) Clinical data \rightarrow Braden scale score, co-morbidities, body temperature
- 3) Environment factors \rightarrow ambient temperature, humidity

Table 2: Site of thermal images captured

Case patient	Control patient
 PI and non-PI site 	 Either heel or sacral based on
 Left PI heel vs Right non-PI heel 	matching variables
• Sacral PI site vs 10cm adjacent of the	
non-PI site of sacrum	

Figure 3. Thermal images of patient's sacral PI obtained using the CAT S60 Thermal Imaging Rugged Smartphone



Discussion

- Elevated temperature in tissues and skin may indicate early PI development.
- Prolonged loading results in an increase in skin surface temperature and erythema on the skin of sacral and heel.^{2,3}
- Surface skin temperature may vary due to blood redistribution and body fat (BF) %. BMI showed no difference between case and control.
- Recommendations for future studies: (1) longitudinal study with longer

• A wound care nurse verified the PI

Figure 1. Using CAT S60 Thermal ImagingFigure 2. Skin Tone Reference using FitzpatrickRugged SmartphoneSkin Types Scale





Skin Type Reference: Type I and II – whites and Japanese Type III and IV – Asian Chinese and fair Malay Type V – Asian Indian Type VI - African black follow-up; (2) bigger sample size; (3) darker skin tones for further validate use of IRT; and (4) consider body fat percentage and skin parameters.



Utilizing IRT technology at bedside may aid in diagnosing early stage PI and suspected DPTI (intact skin) among patients with Type II and III skin tone. More research is still needed to determine if IRT can be used to assist nurses in detecting early stage PI among patients with darker skin tone.



1. Nakagami G, Sanada H, Iizaka S, Kadono T. et al. Predicting delayed pressure ulcer healing using thermography: a prospective cohort study. J Wound Care 2010;19(11): 465-72.

Yusuf S, Okuwa M, Shigeta Y, Dai M. et al. Microclimate and development of pressure ulcers and superficial skin changes. Int Wound J 2015;12(1): 40-6.
 Judy D, Brooks B, Fennie K, Lyder C. et al. Improving the detection of pressure ulcers using the TMI ImageMed system. Adv Skin Wound Care 2011;24(1): 18-24.