Unconventional Research

Diagnostic accuracy of organ electrodermal diagnostics

A pilot study

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Objective. To estimate the diagnostic accuracy as well as the scope of utilisation of a new bio-electronic method of organ diagnostics.

Design. Double-blind comparative study of the diagnostic results obtained by means of organ electrodermal diagnostics (OED) and clinical diagnoses, as a criterion standard.

Setting. Department of Surgery, Helen Joseph Hospital, Johannesburg.

Patients. 70 pre-selected inpatients of mean age 36 (SD = 7) years with suspected pathology of one (or more) of the following organs: oesophagus, stomach, duodenum, biliary tract, pancreas, colon, kidneys and urinary tract. In total, 276 of the abovementioned internal organs were selected for statistical consideration.

Main outcome measures. The difference between the so-called basic electrical impedance of the skin and the impedance value established for a particular organ projection area (the skin zone corresponding to a particular internal organ).

Results. In total 250 true OED results were obtained from the 276 subjects considered: detection rate 90.6% (95% CI 87.1 - 94.1%). Established OED sensitivity was 91.8% (95% CI 88.6 - 95.0%) and OED specificity equalled 89.9% (95% CI 86.4 - 93.4%). The predictive value for positive OED results was 83.3% (95% CI 78.9 - 87.7%) and for negative OED results 95.2% (95% CI 92.0 - 98.4%). The OED results were affected neither by the type nor the aetiology of disease, i.e. OED estimates the actual extent of the pathological process within particular organs but does not explain the cause of pathology directly. No side-effects of the OED examinations were observed.

Conclusions. So-called organ projection areas do exist on the skin surface. The electrical impedance of the projection areas corresponding to diseased organs is increased, relative to that of healthy organ-related skin zones. The difference in impedance is proportional to the intensity of the pathological process. OED, which utilises these electrical phenomena of the skin, may detect diseased organs and estimate the extent of pathological process activity within these organs.

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Various specific relationships between the skin and internal organs are known. Pain sensitivity (e.g. as assessed by means of Head's dermatomes), skin temperature, colour as well as electrical parameters may be changed by internal organ pathology. Correlations between skin electrical resistance and psychological status (psychogalvanic reaction), endocrinological function and autonomic innervation of particular dermatomes are also well known. The electrical current perception threshold demonstrates changes in many diseases.

Many authors have investigated the specific influences of particular organ pathology on the electrical parameters of the corresponding skin areas.[1-11] Diagnostic methods based upon measurements of electrical potential, resistance and impedance of these zones have been proposed; however, their diagnostic accuracy has not been proven and reproducibility has not been consistent. Some of these methods utilise specific bio-electrical properties of acupuncture points.[1,3-11] These include: 'EAV' by Voll[4,5,7,10,11] with modification 'Vegatest',[4] 'Ryodoraku' after Nakatini[1,3,7,10] with modification 'CITO',[7,10] many types of auricular electropunctural diagnostics[6,7,10] and some methods based upon corpolar acupuncture point impedance measurements.[7,8,10]

Different measurement techniques and different electrical parameters of the measurement currents have been used in the abovementioned methods. The results obtained often depend on the patient's muscular tension, emotional condition, skin humidity, procedure duration, environmental temperature and the pressure of the measuring electrode. Therefore these methods did not find widespread application in contemporary medicine and the authors' ideas did not create a unified and systematised scientific basis for the utilisation of bio-electrical skin properties for organ diagnostics.

The first author's own investigations of the skin electrical characteristics[9,12-16] showed that after the so-called electrical breakthrough effect was obtained in skin areas related to diseased organs, an asymmetry of electrical resistance characteristics was observed. This asymmetry is based upon the increased skin resistance for a positively polarised measuring electrode compared with the resistance for negative polarisation of the same electrode (semi-conductivity phenomenon). Also, the impedance of skin zones corresponding to diseased organs is increased, compared with that of the healthy organs' projection areas.

The abovementioned findings create a basis for a new non-invasive diagnostic method — organ electrodermal diagnostics (OED).[9,17-23] The location of electrical resistance asymmetry and increased impedance areas on the skin surface, although often remote, may indicate which organs

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are involved in the pathological process. The degree of asymmetry or the difference in impedance may indicate the activity of disease.

This research study is aimed at estimating the diagnostic accuracy as well as the scope of utilisation of a new OED system, 'Diagnotronics'.

Patients and methods

A comparative study of clinical diagnoses and OED results was performed by means of a double-blind trial on a group of 70 inpatients at Helen Joseph Hospital's surgical department. The group consisted of 37 men and 33 women of mean age 36 (SD = 7) years. During the post-intake ward rounds, the surgical consultants had pre-selected newly admitted patients with suspected pathology of one (or more) of the following organs: oesophagus, stomach, duodenum, biliary tract, pancreas, colon, kidneys and urinary tract. These organs are relatively easy to access clinically, and their pathologies represent a variety of aetiological and pathogenetic factors, e.g. infections, inflammation, neoplasms, and immunological and metabolic disorders.

In each case, the OED examination of all the abovementioned organs was undertaken before the final clinical diagnosis was established. The OED investigator had no access to the patient's documentation whatsoever and OED examinations were always witnessed independently to avoid the suspicion of any communication between investigator and patient. The documented OED results were placed in a special container immediately after the examination was completed; this was only opened after the routine clinical investigation had been concluded.

Clinical investigations of the chosen internal organs comprised:

1. Oesophagus — history and physical examination, chest radiograph, barium swallow, oesophagoscopy with biopsy for confirmation/exclusion of oesophagitis or a neoplastic process. Operative findings were included if the patient had undergone surgery.
2. Stomach and duodenum — history and physical examination, barium meal, gastroduodenoscopy with biopsy for confirmation/exclusion of mucosal inflammation or a neoplastic process. Operative findings were included if the patient had undergone surgery.
3. Biliary tract — history and physical examination, acute phase indicators, liver function tests, hepatitis markers, urine for bilirubin and urobilinogen assessment, ultrasound examination, cholecystogram/cholangiogram (if indicated), hepatic immuno-diacetic acid (HIDA) cholescintigraphy (if indicated). Operative findings were included, if the patient had undergone surgery.
4. Pancreas — history and physical examination, serum and urine amylase, blood glucose, faecal fats, ultrasound examination, abdominal radiograph, computed tomography (CT) scan, endoscopic retrograde cholangiopancreatography (ERCP). Operative findings were included, if the patient had undergone surgery.
5. Colon — history and physical examination, full blood count, barium enema, sigmoidoscopy and/or colonoscopy. Liver function test, liver ultrasound examination, CT scan (if indicated). Operative findings were included, if the patient had undergone surgery.
6. Kidneys and urinary tract — history and physical examination, urine for microscopy culture and susceptibility, urea and electrolytes, creatinine clearance, acute phase indicators, ultrasound examination, intravenous pyelogram. CT scan, cystoscopy and renal biopsy were performed if indicated. Operative findings were included, if the patient had undergone surgery.

OED examinations were performed by means of the prototype OED device, Diagnotronics (Fig. 1). This electronic apparatus makes organ diagnoses based on an automatic impedance evaluation of the skin areas corresponding to particular internal organs. To avoid the problem of individual basic skin impedance, which is different for each person, Diagnotronics first estimates the impedance value for a calibration electrode of 2 cm diameter; this is used as a point of reference and then compared with the diagnostic results obtained with a measurement electrode of 1 mm diameter.[20]

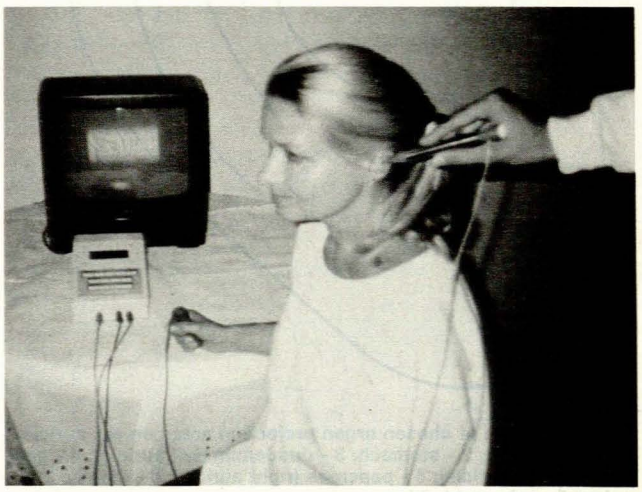

Fig. 1. OED by means of Diagnotronics.

The examination entails placement of the reference electrode on any area of the patient's skin, e.g. on a hand, and the placement of the measurement electrode, after the abovementioned calibration, on the skin area corresponding to the particular organ (organ projection areas of ear auricles were used in this study) (Fig. 2). Using a liquid crystal display, the OED device specifies the actual condition of the organ related to the investigated skin area as 'Healthy 0°', 'Disease I°' (within normal limits), 'Disease II°' (subacute pathology), 'Disease III°' (acute pathology). A special display graded according to percentage of the disease intensity makes it possible to specify accurately the activity of organ pathology. By means of a TV screen the device demonstrates the locations of skin areas corresponding to the examined organs; it also projects diagnoses after the examination is completed.

A special OED information sheet was given to each patient prior to examination. Ethical approval was obtained from the Ethics Committee of the University of the Witwatersrand.

The comparison of clinical diagnoses and OED results was undertaken by an independent arbiter who was not

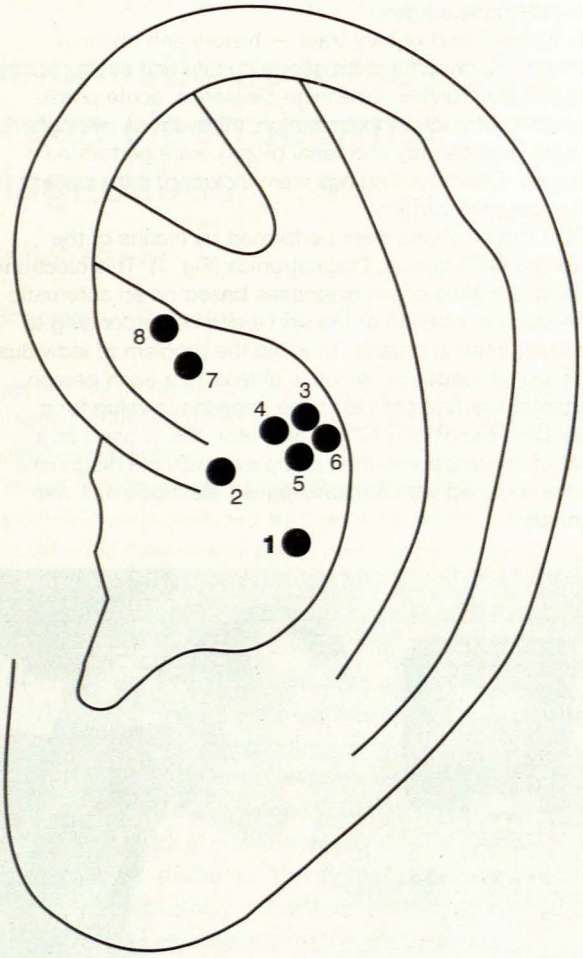

Fig. 2. Location of chosen organ projection areas on ear auricle: 1 - oesophagus; 2 - stomach; 3 - duodenum (left auricle); 4 - gall bladder (left auricle); 5 - pancreas (right auricle); 6 - kidney; 7 - colon; 8 - urinary bladder.

involved in the diagnostic procedures. OED sensitivity was defined as the proportion of correctly classified positives, i.e. 'true positives' among the total of diseased persons.[24,25] The sensitivity rate was estimated with the formula:

$$s = \frac{a}{(a + c)} \times 100$$

s = sensitivity rate; a = true positive; c = false negative.

OED specificity was defined as the proportion of true negatives among the total of persons free of disease.[24,25] The specificity rate was estimated with the formula:

$$sp = \frac{d}{(b + d)} \times 100$$

sp = specificity rate; d = true negative; b = false positive.

The positive predictive value of the OED result was defined as the probability of having the disease among the group of persons classified as positive by OED:[24,25]

$$PV\ (pos) = \frac{a}{(a + b)} \times 100$$

PV = predictive value rate; a = true positive; b = false positive.

The negative predictive value of the OED result was defined as the probability of not having the disease among the group of persons classified as negative by OED:[24,25]

$$PV\ (neg) = \frac{d}{(c + d)} \times 100$$

PV = predictive value rate; d = true negative; c = false negative.

The χ^2-test was used to calculate statistical significance. $P < 0.05$ was accepted as the statistically significant difference. Only organs with proven clinical conditions (healthy/diseased) were considered for final statistical comparison.

Results

In total, 250 true OED results were obtained from the 276 subjects considered: detection rate 90.6% (95% CI 87.1 - 94.1%) (Table I). Established OED sensitivity was 91.8% (95% CI 88.6 - 95.0%) and OED specificity equalled 89.9% (95% CI 86.4 - 93.4%). The predictive value for positive OED results was 83.3% (95% CI 78.9 - 87.7%) and for negative OED results 95.2% (95% CI 92.0 - 98.4%).

The patient subgroups representing one of the chosen internal organs were generally too small for statistical conclusions (pilot study) but some tendencies were noted: healthy organs usually display the OED result 'Healthy' or 'Disease I°', while subacute pathology displays 'Disease II°' and acute pathology 'Disease III°'. The OED results were affected neither by the type nor the aetiology of disease, i.e. OED estimated the actual extent of pathological process activity within particular organs but did not explain the direct cause of pathology.

The OED results were not influenced by a patient's muscular tension, emotional state, skin humidity, environmental temperature, or by procedure duration. The pressure of the measuring electrode had a limited influence (up to 5%) on the OED results and did not affect final diagnoses. No side-effects of the OED examinations were observed.

Discussion

OED probably belongs to that area of medical diagnostics which utilises the nervous system's information function.[26] The OED diagnostic results obtained in this study confirmed the existence of so-called organ projection areas on the skin surface. These specific areas have been used especially in reflexive physiotherapy, e.g. acupuncture, pressopuncture, analgesic electrostimulation, laser therapy and reflexive thermotherapy. However, there was no direct evidence of the real functional connection between the skin surface and particular internal organs. OED has made possible the precise individual localisation of optimal skin areas for reflexive physiotherapy, which might increase its therapeutic efficacy.

In comparison with other known diagnostic methods which utilise the connection between bio-electrical skin properties and the state of internal organs,[1-11] OED results are fully reproducible and reliable. They are independent of procedure duration and the patient's muscular tension,

Table I. Comparison of clinical diagnoses and OED results obtained by means of the Diagnotronics device

Organ	Clinical diagnosis	No. of subjects	True OED results						False OED results					
			Negative			Positive			Negative			Positive		
			0°	I°	Together	II°	III°	Together	0°	I°	Together	II°	III°	Together
Oesophagus	Healthy	26	13	12	25							1		1
	Oesophagitis	8				4	3	7		1	1			
	Cancer	6					6	6						
Stomach	Healthy	18	4	11	15							2	1	3
	Gastritis	15				8	4	12	1	2	3			
	Ulcers	3				1	2	3						
	Cancer	4				1	3	4						
Duodenum	Healthy	26	8	14	22							3	1	4
	Duodenitis	5				4	1	5						
	Ulcers	4					3	3		1	1			
Gall bladder	Healthy	27	8	17	25							2		2
	Gallstone	15				5	8	13		2	2			
	Cholecystitis													
	Acute	2					2	2						
	Chronic	3				2	1	3						
Pancreas	Healthy	7	2	3	5							1	1	2
	Pancreatitis													
	Acute	3					3	3						
	Chronic	9				5	3	8		1	1			
Colon	Healthy	4	4		4									
	Colitis	4				3	1	4						
	Cancer	3				2	1	3						
Kidneys	Healthy	41	20	18	38							3		3
	Pyelonephritis	2				2		2						
	Nephrolithiasis	7				1	6	7						
Urinary bladder	Healthy	29	17	9	26							3		3
	Cystitis	1					1	1						
	Cancer	4				2	2	4						
Total		276			160*			90*			8			18

* Statistically significant difference between the total sum of true and false results: $P < 0.0001$.
Detection rate = 90.6% (87.1 - 94.1%); Sensitivity rate = 91.8% (88.6 - 95.0%); Specificity rate = 89.9% (86.4 - 93.4%); Predictive value rate (pos.) = 83.3% (78.9 - 87.7%); Predictive value rate (neg.) = 95.2% (92.0 - 98.4%).

emotional state, skin humidity, and environmental temperature, and show only a limited correlation with the measuring electrode's pressure on the skin.

This pilot study indicates the high diagnostic accuracy of OED as well as its usefulness in clinical practice. A full clinical evaluation of this new bio-electronic system of non-invasive medical diagnostics should now be undertaken with an adequate number of patients.

Conclusions

1. So-called organ projection areas do exist on the skin surface. The electrical impedance of the projection areas corresponding to diseased organs is increased, relative to healthy organ-related skin zones. The difference in impedance is proportional to the intensity of the pathological process.

2. OED, which utilises the abovementioned electrical phenomenon of the skin, seems to be a reliable bio-electronic method of non-invasive medical diagnostics, with high rates of sensitivity and specificity. OED may detect diseased organs and estimate the extent of pathological process activity within these organs.

3. The OED results are affected neither by the type nor the aetiology of disease, i.e. OED cannot directly explain the cause of pathology.

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