SKIN-FOLD THICKNESS IN NORMAL SUBJECTS AND IN PATIENTS WITH ACROMEGALY AND CUSHING'S SYNDROME

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ABSTRACT

A simple clinical method of determining the skin-fold thickness on the dorsum of the hand has been described using the Harpendon spring-loaded caliper. A normal range for age and sex has been established in 258 normal subjects. The mean skin-fold thickness was greater in men than in women, and in both decreased with age, falling from 2.85 to 1.75 mm in men, and from 2.65 to 1.60 mm in women (aged 15–20 to 70–80). In 48 acromegalic patients, 71% of the skin-fold measurements were abnormally thick. In 12 patients with Cushing's syndrome, although all measurements were below the normal mean, 42% only were abnormally thin.

The thick skin in acromegaly and the thin skin in Cushing's syndrome are useful clinical signs. This has been confirmed radiologically (Sheppard & Meema 1967), but a simple bedside method for this measurement has not been described. Using a standard spring-loaded caliper in a similar manner as described by Smith et al. (1967), we have measured the skin-fold thickness on the dorsum of the hand in acromegaly and Cushing's syndrome. The value of this skin-fold measurement in the diagnosis of these conditions has been assessed by comparing the measurements with those from a large group of normal subjects.

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METHODS

Skin-fold measurements.

The skin-fold on the dorsum of the hand over the mid-point of the third metacarpal bone was selected as the standard site for measurement. A small skin-fold in the long axis of the hand is lifted up by the fingers and placed between the blades of a Harpenden skin-fold caliper*. The height of the skin-fold is standardised to reach exactly to the top of the jaw-blades. It is convenient to have the patient's hand placed flat on a table, with the wrist in a neutral or extended position (Fig. 1).

The caliper, which was originally designed to measure subcutaneous fat in a large fold of skin and underlying fat raised over the upper arm or trunk, is constructed so that a constant pressure of 10 g/mm² is exerted at all openings of the blades. The distance between the jaw-blades is shown on the dial which can be conveniently read to 0.1 mm. For the present study, three separate readings were taken on each hand. The value for any individual patient was expressed as the mean of the six measurements.

Fig. 1.

A fold of skin over the third metacarpal is placed between the blades a Harpenden skin-fold caliper.

* Available from British Indicators (Sales) Ltd., St. Albans.
Patients studied

The skin-folds of 123 male and 135 female European members of staff and visitors to the hospital were measured. The age range was from 15 to 80 years; 20 male and 20 female subjects were included in each decade from 21–70 years. Subjects were selected at random, but obviously obese subjects and those with skin disease and hand injuries were excluded. Measurements were also made on 12 patients with simple obesity who were more than 20% above their ideal body weight.

The skin-folds of 48 acromegalic patients were measured; 41 patients were untreated, and in the other seven external irradiation had been given to the pituitary gland but the disease had remained active. None of these patients was receiving corticosteroids. Measurements were made on 12 patients with untreated Cushing’s syndrome due to bilateral hyperplasia or adrenal adenoma. The diagnosis of acromegaly or Cushing’s syndrome was clinically obvious in all cases, and was confirmed by objective tests as indicated by Joplin et al. (1961).

Reproducibility

One observer could easily make a number of measurements on one hand which agreed within 0.1 mm. Occasionally it was difficult to obtain a precise measurement on very thickened skin with a coarse fold. In a few normal adolescent subjects it was not possible to pick up a true skin-fold without including a significant amount of subcutaneous tissue; results from such subjects were not included. Two observers independently measured the skin-fold of 28 hands. The results were in close agreement; 90% were within 0.2 mm and all were within 0.4 mm.

Handedness

Although differences between the hands of one individual were usually very small, a difference of as much as 0.6 mm was observed occasionally. Differences did not appear to be related to the right or left handedness in either sex. The mean value of all the right hand measurements did not differ from the mean value of all the left hand measurements by more than 0.003 mm in both men and women.

RESULTS

1. Normal subjects (Fig. 2)

The mean skin-fold thickness decreased with increasing age. In men the skin-fold fell from 2.85 mm (aged 15–20 years) to 1.75 mm (aged 70–80 years), and in women from 2.65 mm (aged 15–20 years) to 1.60 mm (aged 70–80 years). A significant difference ($P < 0.05$ to $< 0.001$) was found between men and women in every decade from 21 to 60 years, the mean value for all men being 0.3 mm greater than for all women. This sex difference was less certain for the extremes of age.

The individual values within each decade in both men and women appeared to be normally distributed. The scatter of values appeared similar from decade to decade. A normal range for each sex was constructed, being based on the mean for each decade ± 2 S.D. As there was no trend for the scatter to vary with age, the S.D. quoted is the mean S.D. of the decades considered. Only
SEX DIFFERENCE IN SKIN-FOLD THICKNESS
(NORMAL SUBJECTS)

Fig. 2.
Skin-fold thickness declines with age. The mean value for men was 0.3 mm greater than for women.

2% of all the 258 measurements of normal subjects lay outside this normal range. These data have been used to assess patients with acromegaly and Cushing’s disease, considering the females in Fig. 3 and males in Fig. 4.

The values in the obese patients all fell within the normal range except in one man whose skin-fold was abnormally thick.

2. **Acromegaly**

The results in acromegaly are compared with the normal range in women (Fig. 3) and in men (Fig. 4). It is seen that the skin-fold was abnormally thick in 34 (71%) of the total group of 48 patients. 82% of the male acromegalics were abnormal but only 62% of the female. This difference in sex incidence is not significant (P > 0.05). The seven patients who had had external irradiation treatment did not differ from the untreated patients. When the 6 patients with a skin within one S.D. from the mean normal value were considered, it was found that there were no obvious clinical differences or difference in the estimated duration of acromegaly, when they were compared with the other patients.

3. **Cushing’s syndrome**

The skin-fold measurements in every patient with Cushing’s syndrome was below the normal mean value. However, in only five patients (42%) was the
measurement abnormally low. The two patients with measurements within one S. D. of the mean were aged 28 and 30 years.

DISCUSSION

The skin-fold on the dorsum of the adult hand normally includes very little subcutaneous tissue and is therefore largely a measure of the thickness of the dermis (McConkey et al. 1963). Our skin-fold measurements have shown a progressive loss of thickness with increasing age, which is probably due to a progressive loss of collagen as has been shown by biopsy studies of forearm skin of normal subjects (Shuster et al. 1967).

Radiological measurements of the skin thickness of the forearm, however, did not reveal any significant change with age in a group of normal female controls aged 20 to 60 years when those aged 42 and under were compared with those aged 43 and over (Sheppard & Meema 1967). On the contrary when our results were analysed in a similar way, comparing subjects aged 20–40 years
with subjects aged 40–60 years, it was found that there was a highly significant difference in both male \( (P < 0.001) \) and female groups \( (P = 0.001) \). Our finding of thicker skin-fold in male compared to female controls does agree with the radiological observations. It is also interesting to note that our method measures two layers of skin and should therefore give values that are double the radiological measurements; our mean male and female skin-fold thickness was approximately 2.3 mm and 2.1 mm respectively, which is comparable with but not quite double the radiological measurements of 1.43 mm and 1.34 mm. The radiological method is clearly advantageous when occasionally it is not possible to lift a skin-fold clear of subcutaneous tissue in the young and in the obese subject.

The importance of relating a patient’s skin-fold thickness measurement to a normal range based upon normal subjects of the same age and sex is clear from Fig. 2, and is illustrated in our study of acromegalic patients (Figs. 3 and 4). Although many acromegals had abnormally thick skin-folds, the finding of normal values clearly does not exclude the diagnosis. However, by following the effect of treatment of the acromegaly it may emerge that some acromegals with initial values within the normal range still show a reduction. In their radiological study of skin thickness Sheppard & Meema (1967) also found that

Fig. 4.
Skin-fold thickness in male patients –
• acromegaly (22)  × Cushing’s syndrome (1).
a high proportion (95.5%°) of acromegals had abnormally thick skin when compared with normal limits for the same sex.

The clinical impression of thin skin in Cushing's syndrome has been confirmed by our skin-fold measurements, but the values were frankly abnormal in only 5 of 12 patients. It is possible that the skin-fold method is not sufficiently sensitive for the accurate measurement of very thin skin because Sheppard & Meema (1967) found 7 or 8 patients with Cushing's syndrome to have abnormally thin skin. Using a similar caliper method as described in this report, thin skin-folds have been shown to occur in patients with rheumatoid arthritis when treated with corticosteroids (Greenwood 1966).

The skin-fold measurement can thus be of considerable diagnostic use in acromegaly, and in both acromegaly and Cushing's syndrome may provide a useful objective, soft-tissue measurement than can be repeated easily when following the response to treatment.

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REFERENCES


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