Opinion

Skin line and subcutaneous fat in radiology: Opinion

Abstract

The aim of this paper is to shed light on a neglected topic in radiology which is imaging the skin and subcutaneous fat. A few studies showed that imaging of skin line and subcutaneous fat have clinical benefits for health, cosmetic reasons, and overall wellbeing. This paper will list many issues that can be diagnosed when evaluating a skin line, fold, and subcutaneous fat on different imaging modalities like; X-ray, ultrasound, CT, MRI, etc. Furthermore, this paper will show a comparison of those imaging modalities in terms of measurement accuracy, diagnosis of skin and subcutaneous fat diseases, comparison of males and females in terms of fat buildup, and so on. According to the available literature, men have more fat than women in the inner deep layer, but women have more body fat than men. Furthermore, as previously hypothesized and proven wrong, recent paper shows that there is no water in the adipose tissue. In addition, a hierarchy in evaluating skin folds and subcutaneous fat by using imaging modalities is seen in the following order from low accuracy to high accuracy; caliper, X-ray, ultrasound, CT, etc.

Keywords: Skin line, skin fold, subcutaneous fat, adipose tissue, X-ray, CT, MRI, US

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Abdulwahab Alahmari
Department of Radiology, Al-Namas General Hospital, Saudi Arabia

Correspondence: Abdulwahab Alahmari, Radiology Specialist, Department of Radiology, Al-Namas General Hospital, Ministry of Health, Al-Namas City, Saudi Arabia, Tel +966562428716, Email afaa9@hotmail.co.uk

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Both skin and subcutaneous fat can be seen on different imaging modalities. Low energy X-rays will reflect from the skin, which will make the skin appear lighter on X-ray. X-rays pass through many items, including skin, and give off patterns of white light on the film. The more dense an object is, the more difficult it is for X-rays to pass through it, so shadows that appear on the film show up as dark areas. On an X-ray, the skin line and subcutaneous fat appear very clear, for example, in the breasts, axilla, etc. On a CT scan, the skin line and subcutaneous fat appear in all body parts. The skin line and fold can create an artifact known as the Mach band effect, which is the result of a dark object located next to a lighter object, which will form a pseudo-shadow. This shadow can be mistaken for a disease based on the region that the skin fold is located in. The skin line discontinuity can appear like a gap which is a sign for a foreign body. The subcutaneous fat can help in identifying a subtle fracture on an X-ray. On a CT scan, the subcutaneous fat can be measured to give an estimation for the patient to know about the layers of fat that have built up on them, or in some cases, if they follow a diet or have had liposuction surgery, to see how much change has been made to the subcutaneous fat layer. On an MRI, the fat can be seen without using the fat suppression sequence to show the amount of adipose tissue that the patient has. Both T1 and T2 can show the fat because the fat has a high and long signal, while both T1 and T2 have a very short relaxation time, so the adipose tissue will appear on both sequences. Sometimes a small amount of fat cannot be seen on MRI scans, which may cause a chemical shift or ghosting artifact on MRI due to subcutaneous fat. Skin lesions can be detected on plain radiographs as a density on the surface. That's why mammography and tomosynthesis, a.k.a. 3D mammography, are used to evaluate the breasts. The results are reported by using a radiograph that shows a shadow that is irregular in shape with well-defined borders and a relatively higher density. "A skin X-ray" can show skin conditions like; melanoma, basal cell carcinoma, and erythroderma. The skin and subcutaneous fat on X-rays and CT scans are a good way to look at the thickness of the skin and see how it changes over time? You can see from this example that there are areas where the skin is much thicker than other areas, and both X-ray and CT might show signs of injuries like deep burns. The use of an X-ray and other imaging modalities with skin conditions is analogous to the use of thermal imaging (i.e., a thermograph) in cancer detection, which is both primitive and understudied. Despite the fact that thermal imaging use for medical imaging has been proposed since the 1970s, but it is not as well-known as the other imaging modalities. Since subcutaneous fat works as a cushion, a contusion or "fracture" of subcutaneous fat can be spotted on ultrasound. Fat stranding can be a sign of a pathology on a CT scan, as in hernias and other pathological processes. As well, the skin line and the subcutaneous fat will appear as an outpouching sac. The usefulness of using imaging modalities to image the skin and subcutaneous fat is beyond what is mentioned in this paper!

According to Black et al., ultrasound measurements of skin and subcutaneous fat were smaller than CT scan measurements of skin and subcutaneous fat. At the same time, ultrasound measurements were more accurate than the caliper technique of measuring skin folds and fat.[1] According to Querleux et al., using an MRI to evaluate adipose tissue showed that an increased inner fat layer in women is associated with cellulite, which has cosmetic implications. Furthermore, MRI spectroscopy did not show the existence of water in the adipose tissue, which proves a previous hypothesis wrong but might indicate that water accumulates in connective tissue septae.[2] According to Smith et al., who used DEXA and CT scans to evaluate men and women, men have 66% of their fat in the deep layer compared to 51% for women. But women have a higher total weight of body fat where women scored 45.2±7.0 kg and men scored 29.5±8.7 kg. In addition, women's body fat percentage was 38.0 11.0 kg, while men's was 29.4 13.7 kg.[3]

In conclusion, imaging of skin folds and subcutaneous fat is important, and it has clinical benefits for health, cosmetic reasons, and overall wellbeing. A hierarchy in evaluating skin folds and subcutaneous fat is seen in the following order from low to high: caliper, X-ray, ultrasound, DEXA, CT, MRI, etc.

Conflicts of interest

Author declare that there is no conflicts of interest.

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