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Original Research Article

# Preoperative assessment of skin tumor thickness and structure using 14-MHz ultrasound

Vesta Kučinskienė [a,*], Daiva Samulėnienė [a], Aistė Gineikienė [a], Renaldas Raišutis [b], Rymantas Kažys [b], Skaidra Valiukevičienė [a]

[a] Department of Skin and Venereal Diseases, Medical Academy, Lithuanian University of Health Sciences, Kaunas, Lithuania
[b] Ultrasound Institute, Kaunas University of Technology, Kaunas, Lithuania

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ABSTRACT

*Objective:* The aim of this study was to compare the relationship between skin tumor thickness and homogeneity and to evaluate the accuracy of 14-MHz ultrasound while measuring the thickness of different skin tumors.

*Material and methods:* The ultrasonographic and histological analysis of 72 skin tumors was performed. Preoperative vertical tumor thickness (*T*) and structure of 12 melanomas, 34 melanocytic nevi and 26 basal cell carcinomas was assessed by 14-MHz ultrasonography. After the tumors were excised the vertical thickness measurement (Breslow index, p*T*) was performed by pathologist. According to the histological thickness all skin tumors were divided to thin (≤1 mm) and thick (>1 mm). The accuracy of the 14-MHz ultrasound measurements and correlation between the ultrasonographic and histological tumor thickness were estimated.

*Results:* Homogeneous structure was assessed for all thin (≤1 mm) and the majority (81.3%) of thick (>1 mm) melanocytic skin tumors. Nonhomogeneous structure was estimated in thin and thick basal cell carcinomas, accordingly 42.9% and 31.9%. Measurements of *T* and p*T* correlated moderately in thick (>1 mm) tumors ($r = 0.694$), while in thin (≤1 mm) tumors correlation was low ($r = 0.336$). Moderate correlation between ultrasonographic and histological thickness was computed for melanocytic skin tumors as well as for basal cell carcinomas ($r = 0.564$ and $r = 0.690$).

*Conclusions:* Medium frequency ultrasound is not a reliable tool for the precise measurement of thin (≤1 mm) skin tumors. Ultrasonography using a 14-MHz frequency transducer enables more precisely to measure the thickness of basal cell carcinoma than melanocytic skin tumors. The 14-MHz ultrasound is support tool to suggest the morphologic type of skin tumor.



* *Corresponding author at*: Department of Skin and Venereal Diseases, Medical Academy, Lithuanian University of Health Sciences, Eivenių 2, 50009 Kaunas, Lithuania.
E-mail address: kvesta@delfi.lt (V. Kučinskienė).

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## 1. Introduction

Ultrasound is a noninvasive technique that provides complementary information to the clinical examination of various skin lesions, especially skin tumors. Ultrasonographic assessment of skin tumor margins, thickness, echo pattern and its location may aid the diagnosis, plan the treatment or detect subclinical recurrence of the tumor after treatment.

The prediction of surgical margins of skin melanoma and performance of sentinel lymph node biopsy are based on the tumor thickness assessed according to Breslow [1–3]. Excisional biopsy with histological analysis is the best way to determine the precise tumor thickness. However, it may damage the lymphatic vessels, altering the pattern of tumor drainage, particularly in anatomic regions with ambiguous lymphatic circulation (e.g., neck and trunk) [4–6].

Basal cell carcinomas (BCCs) are more accurately identified and measured ultrasonographically, often yielding the larger measurements than those obtained at clinical examination which can be particularly important at locations with a higher risk of recurrences, mainly face [7–9]. According to the 7th edition of the American Joint Committee on Cancer Classification (AJCC), the thickness more than 2 mm of BCC has been included as one of the high-risk factors for tumor staging [10]. Ultrasound allows the surgical planning of BCC to be adapted by identifying the extent of the tumor. It can also help to monitor the early detection of recurrence of BCC [11–13].

In previous studies investigators have evaluated good accuracy of the ultrasonography with higher than 20-MHz scanners to determine the margins and thickness of BCC and skin melanoma [4,5,8,14]. Assessment of skin melanoma thickness using transducers of 100-MHz frequency has better agreement with histology compared to 20-MHz ultrasonography. There is the tendency of 20-MHz device to overestimate tumor thickness because of several factors, e.g. tumor regression, lymphocytic infiltration [15]. However, in case of 100-MHz ultrasonography, the ultrasonic penetration depth is limited to 1.5 mm [5]. In the recent years technologic advances have improved the quality of the more commonly available ultrasonic scanners having frequency close to 15 MHz, allowing axial and lateral resolutions of 0.1 mm in superficial planes at those frequencies [16]. There are reported data showing higher agreement between ultrasonically and histologically determined thickness in thicker (>2 mm) skin melanomas and lower in thinner (1–2 mm) skin melanomas while using a 14-MHz ultrasound transducer [17]. Other investigators give a high accuracy of 10-MHz ultrasound measurements when evaluating skin melanomas of >1 mm thickness [18]. The thickness of BCC can be accurately estimated when using a 7–15-MHz ultrasound transducer [7]. Higher frequency ultrasonography can show nonhomogeneously scattered internal echoes in basal cell carcinoma and homogeneous reflex pattern in melanoma [11,19]. There is insufficient information about the effectiveness of 14-MHz ultrasound when estimating the homogeneity of skin tumors.

According to these controversial results we designed a study to evaluate the accuracy of 14-MHz ultrasound for the preoperative assessment of the thickness and structure of melanocytic skin tumors and BCC.

## 2. Material and methods

A total of 72 patients (26 men and 46 women) with clinically and dermatoscopically identified melanocytic tumors and BCCs in various locations before the excision were included in the study. The study was carried out from January 2010 through 2011. The tumor structure and thickness were evaluated ultrasonographically before surgical treatment. The maximum tumor thickness (*T*) measurements were made in B-scan from the lower edge of the entry echo to the inferior boundary of the echo-poor region representing the tumor (Figs. 1 and 2). Vertical tumor thickness of 34 melanocytic nevi, 12 melanoma and 26 basal cell carcinoma was preoperatively assessed using a 14-MHz Toshiba Xario XG ultrasonic scanner (Tokyo, Japan). All skin tumors were surgically excised and processed for routine histopathology. The vertical distance from the uppermost level of the stratum granulosum in the epidermis to the lowest point of the tumor (Breslow index, p*T*) was recorded in mm. The pathologist who measured the tumor thickness did not know the thickness of the lesion estimated by ultrasonography. According to the histological thickness (p*T*) all skin tumors were divided to thin (≤1 mm) and thick (>1 mm). Melanocytic skin tumors (melanocytic nevi and melanoma) were analyzed together in one group. Distribution of internal echoes (homogeneous or nonhomogeneous) was assessed in skin tumors according to the morphological analysis of an ultrasonographic structure by Altmeyer and Hoffman [19]. Analyses were conducted using SPSS statistical software (version 13.0, SPSS for Windows). The descriptive summary statistics and techniques include frequencies, means, standard deviations, standard errors and graphs. The nonparametric Wilcoxon test, Spearman correlation coefficient, and chi-square test ($\chi^2$) were used for statistical analysis. The data were given as mean values and 95% confidence interval (95% CI) as deemed appropriate. Sensitivity, specificity, and accuracy of the 14-MHz ultrasonography method were calculated when using standard descriptions and formulas for these values given under Table 2.

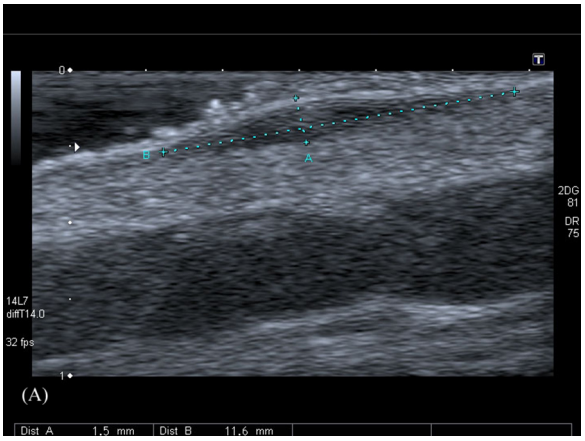


**Fig. 1 – 14-MHz ultrasound image of skin melanoma (*T* = 1.5 mm).**