A cohort study on detection and subtyping of basal cell carcinoma with optical coherence tomography

Research letter

A cohort study on detection and subtyping of basal cell carcinoma with optical coherence tomography: The additional value of distant diagnosis by an expert

To the Editor: Optical coherence tomography (OCT), a non-invasive technique for diagnosis of basal cell carcinoma (BCC) could potentially replace standard biopsy, thereby, enabling physicians to diagnose and initiate treatment during the same consultation.[1,2] The ability of OCT assessors to discriminate between BCC and non-BCC, and between BCC subtypes (superficial BCC vs non-superficial BCC) must be high. However, the discriminative ability of assessors varies due to differences in experience level.[3] This study aimed to evaluate to what extent a distant OCT expert, who cannot directly inspect the patient, could improve the diagnostic performance of a novice OCT assessor.

This study included consecutive patients who underwent an OCT scan (Vivosight Multi-beam Swept-Source Frequency Domain OCT) and subsequent biopsy for lesions suspect for non-melanoma skin cancer. Histopathological examination of punch biopsy served as gold standard. The underlying assumption is that OCT can only replace biopsy if there is high confidence in the presence of BCC and its subtype. In all other cases, patients will still undergo biopsy to establish a final diagnosis and treatment regimen. Diagnostic parameters for high confidence OCT diagnosis were compared between a novice and an expert OCT assessor. The novice was trained using monitoring with cumulative sum analysis and achieved an acceptable performance after assessing 134 scans.[4] He evaluated OCT scans in combination with visual inspection of the suspected lesions, whereas, the OCT expert who was not on site could not inspect the lesions.

A total of 287 lesions were included with a BCC prevalence of 56.8% (163/287). The specificity for non-BCC detection by OCT was 96% for both assessors. Sensitivity for BCC detection was significantly higher for the expert (82.2%) compared to the novice assessor (71.8%) ($P = .005$) (Table I). Sensitivity for non-superficial BCC detection, requiring excision, was significantly higher for the expert (97.6%) compared to the novice assessor (89.2%) ($P = .016$) (Table II).

The high specificity achieved by the novice assessor implies that the risk of misclassifying histopathological non-BCC as BCC was low. The lower sensitivity of the novice assessor resulted in a lower proportion of patients in whom a biopsy could be omitted, but not in more misclassifications. The reason is that in case a high confidence in the OCT diagnosis was lacking (negative OCT result), a biopsy was always obtained. Closer inspection of the 25 BCCs detected by the expert, but missed by the novice assessor revealed that in 40% of cases, the novice assessor was uncertain about BCC subtype, but not about BCC presence.

A limitation of this study is that the results are based on data from only 1 novice and expert assessor. However, the results indicate that a novice assessor can achieve a high ability to discriminate BCC from non-BCC, and that, supervision by an OCT expert can lead to detection of a higher proportion of BCC lesions and better discrimination between BCC subtypes. Remote supervision of the novice assessor by an expert assessor may be valuable for future clinical implementation of OCT, and could be achieved by live interactive teledermatology as described by Rubinstein et al.[5]

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Table I. Diagnostic performance with respect to basal cell carcinoma detection with optical coherence tomography by a novice OCT assessor and an expert OCT assessor. The absolute number of BCCs is given

	Novice assessor % (x/n)	CI	Expert assessor % (x/n)	CI	*P* value
Sensitivity	71.8 (117/163)	(68.1-73.7)	82.2 (134/163)	(78.7-84.1)	.005
Specificity	96.0 (119/124)	(91.2-98.5)	96.0 (119/124)	(91.3-98.5)	1.000
PPV	95.9 (117/122)	(91.0-98.4)	96.4 (134/139)	(92.3-98.5)	.838
NPV	72.1 (119/165)	(68.5-74.0)	80.4 (119/148)	(76.5-82.5)	.087
DOR	60.5	(22.0-180.2)	110	(38.8-336.9)	

BCC, Basal cell carcinoma; *CI*, confidence interval; *DOR*, diagnostic odds ratio; *NPV*, negative predictive value; *OCT*, optical coherence tomography; *PPV*, positive predictive value.

Table II. Diagnostic performance with respect to basal cell carcinoma subtyping by a novice optical coherence tomography assessor and an expert OCT assessor. The absolute number of BCCs is given

	Novice assessor % (x/n)	CI	Expert assessor % (x/n)	CI	*P* value
Sensitivity (nBCC/aBCC)*	89.2 (74/83)	(83.9-92.4)	97.6 (81/83)	(93.0-99.6)	.016
Specificity (sBCC)	80.8 (21/26)	(63.9-91.8)	76.9 (20/26)	(62.2-83.2)	1.000
PPV	93.7 (74/79)	(88.1-97.3)	93.1 (81/87)	(88.7-95.0)	.883
NPV	70.0 (21/30)	(55.4-79.6)	90.9 (20/22)	(73.5-98.3)	.078
DOR	34.5	(9.2-140.1)	135	(21.8-1110.2)	

CI, Confidence interval; *DOR*, diagnostic odds ratio; *nBCC/aBCC*, nodular/aggressive basal cell carcinoma; *NPV*, negative predictive value; *PPV*, positive predictive value; *sBCC*, superficial basal cell carcinoma.
*For analysis, nodular and aggressive BCC subtypes (requiring surgery) were considered.

Conflicts of interest

Dr K. Mosterd participated in an advisory board for Michelson Diagnostics. Drs Wolswijk, Adan, and Nelemans have no conflicts of interest to declare.

REFERENCES

1. Adan F, Nelemans PJ, Essers BAB, et al. Optical coherence tomography versus punch biopsy for diagnosis of basal cell carcinoma: a multicentre, randomised, non-inferiority trial. *Lancet Oncol*. 2022;23(8):1087-1096.
2. Sinx KA, van Loo E, Tonk EH, et al. Optical coherence tomography for noninvasive diagnosis and subtyping of basal cell carcinoma: a prospective cohort study. *J Invest Dermatol*. 2020;140(10):1962-1967.
3. Holmes J, von Braunmühl T, Berking C, et al. Optical coherence tomography of basal cell carcinoma: influence of location, subtype, observer variability and image quality on diagnostic performance. *Br J Dermatol*. 2018;178(5):1102-1110.
4. van Loo E, Sinx KA, Welzel J, et al. Cumulative sum analysis for the learning curve of optical coherence tomography assisted diagnosis of basal cell carcinoma. *Acta Dermato-Venereologica*. 2020;100(12):adv00343.
5. Rubinstein G, Garfinkel J, Jain M. Live, remote control of an in vivo reflectance confocal microscope for diagnosis of basal cell carcinoma at the bedside of a patient 2500 miles away: a novel tele-reflectance confocal microscope approach. *J Am Acad Dermatol*. 2019;81(2):e41-e42.

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