Skin Autofluorescence in Demarcation of Basal Cell Carcinoma

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In the treatment of skin cancers, it is often difficult to *find the tumour borders* (e.g. demarcation), since part of it may not be visible to the naked eye. This can result in incomplete treatment, consequent recurrence and repeated treatments. The repeated treatments may cause tissue destruction and cosmetic morbidity. Therefore, a fast and non-invasive approach for tumour demarcation is needed.

Employing a fluorescence spectrometer system (Fl3095, J&M Anal-

ytische Mess-und Regeltechnik GMBH, Aalen, Germany), we studied the autofluorescence of normal skin and BCC lesions, and its potential in tumour demarcation. Protoporphyrin IX (PpIX) fluorescence and histopathology examination were used as control methods. The influence of skin pigmentation and redness in the fluorescence detection was evaluated, measuring the two parameters with a skin reflectance meter (UV-Optimize, Model Matic 555, Matic, Denmark).

Normal skin autofluorescence included 5 bands that correspond to tryptophan, collagen, elastin, NADH and flavins. The fluorescence of these molecules overlapped greatly with each other. Their fluorescence intensities varied according to body sites, as well as from individual to individual. Skin pigmentation and redness contribute immensely to the variations, yet their influence can be corrected. The corrected intensity of one

fluorescence band (330:369 nm) correlated positively with age.

The median 370:452 nm fluorescence was 53% lower (range 18-84%) in the basal cell carcinomas (BCCs) than in normal skin (p<0.001). This low-intensity fluorescence extended outside the visible tumour border for at least 3 mm in 56% of the tumours. This extension was comparable to the extension of the protoporphyrin IX fluorescence. A correction of the autofluorescence intensity for skin pigmentation and redness reduced the difference between the fluorescence of BCC and normal skin, but the BCC fluorescence was still significantly lower than the normal skin. This indicated that skin pigmentation and redness contributed to the low fluorescence in BCCs, but were not the only cause.

Gross detection of the skin autofluorescence provoked by 370



On June 11, 2001 Dr Renhua Na (*left*) defended her thesis at Bispebjerg Hospital, University of Copenhagen, Denmark. The Opponents were Professor Jørgen Serup (*middle left*), Department of Dermatology, Linköping University Hospital, Sweden and Dr. Gregor G. E. Jemec (*middle right*), Division of Dermatology, Department of Medicine, Roskilde Hospital, Denmark. Faculty Opponent was Dr. Tonny Karlsmark (*right*), The Wound Healing Centre, Bispebjerg Hospital, Copenhagen, Denmark.

nm radiation revealed a dark area in the BCC lesions, and in some cases in the immediate surrounding skin, while normal skin appeared to be light blue. In 47% of the cases, the borderlines of these dark areas was located outside of the visible border for more than 3 mm. In 58% of these tumours, the biopsies taken just inside the borderline contained malignant or other abnormal tissues, while in 8% (2 cases) of the cases the abnormal tissues were also found in the biopsies outside the borderline. Microscopic examination confirmed that the lateral part of the tumour was located in the lower part of the dermis in the false negative cases.

The autofluorescence detection may be useful in skin cancer demarcation. Gross detection of autofluorescence is simple, fast and non-invasive. Yet its effectiveness is limited in the tumours located in the lower dermis. Its clinical utility remains to be tested in practice.

List of original publications

- 1. Na R, Stender IM, Ma L, Wulf HC. Autofluorescence of skin: component bands and body site variation. Skin Res Technol 2000; 6: 112-117.
- 2. Na R, Stender IM, Henriksen M, Wulf HC. Autofluorescence of skin is agerelated after correction for skin pigmentation and redness. I Invest Dermatol 2001; 116: 536-540.
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- 4. Na R, Rossen K, Wulf HC. Skin autofluorescence in demarcation of basal cell carcinoma. (Submitted)



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