

ENHANCING THE MANAGEMENT OF HIGH-RISK BASAL CELL CARCINOMA

Akademisk avhandling

Som för avläggande av Medicine doktorsexamen vid Sahlgrenska akademien, Göteborgs universitet kommer att offentligen försvaras i Arvid Carlsson, Academicum, Medicinaregatan 3, den 11 juni 2025 klockan 09.00

av **Hannah Ceder**

Fakultetsopponent:

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Avhandlingen baseras på följande delarbeten

- I. Hannah Ceder, Annie Ekström, Lajla Hadzic, John Paoli. Clinicopathological factors associated with incomplete excision of high-risk basal cell carcinoma. *Acta Derm Venereol.* 2021;101(7):adv00496. doi:10.2340/00015555-3856.
- II. Hannah Ceder, Malin Grönberg, Martin Gillstedt, John Paoli “Mohs micrographic surgery for primary versus recurrent or incompletely excised basal cell carcinomas”. *Acta Derm Venereol.* 2021;101(2):adv00381. doi: 10.2340/00015555-3698
- III. Hannah Ceder, Eva Backman, Ashfaq Marghoob, Cristián Navarrete-Dechent, Sam Polesie, Ofer Reiter, John Paoli. Importance of both clinical and dermoscopic findings in predicting high-risk histopathological subtype in facial basal cell carcinomas. *Dermatol Pract Concept.* 2024;14(3):e2024212. doi:10.5826/dpc.1403a212.
- IV. Hannah Ceder, John Paoli, Ilkka Pölönen, Mari Salmivuori, Noora Neittaanmäki. Hyperspectral imaging for lateral tumor demarcation of high-risk basal cell carcinomas during Mohs micrographic surgery. In manuscript

**SAHLGRENKA AKADEMIN
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Enhancing the management of high-risk basal cell carcinoma

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Abstract

Basal cell carcinoma (BCC) is the most common skin cancer, with over 71,000 new cases in Sweden in 2023. High-risk facial BCCs are most appropriately treated with Mohs micrographic surgery (MMS), which is considered the gold standard. However, MMS is rarely performed in Sweden due to resource constraints leading to high rates of incomplete excisions and recurrences. The four papers in this thesis address key topics related to high-risk BCCs including risk factors associated with incomplete excisions, differences in outcomes following MMS for primary and previously treated high-risk BCCs, their dermatoscopic features and the feasibility of hyperspectral imaging for tumor delineation prior to MMS.

In Study I, clinical and histopathological risk factors for incomplete excision of high-risk BCCs were evaluated. In our cohort, the overall incomplete excision rate was 20.6%. BCCs located on the nose, ear, scalp, and periorbital areas as well as BCCs with high-risk histopathological subtypes exhibited the highest proportions of incomplete excisions. In study II, we found that primary facial high-risk BCCs required fewer MMS stages and had smaller wound areas after complete surgical removal compared to BCCs that had been treated previously. In Study III, we investigated which clinical and dermoscopic findings characterize high-risk BCCs. A bumpy surface, poorly defined borders, the dermoscopic presence of ‘white porcelain area’ and/or ‘vessels within ulceration’ were indicative of high-risk BCCs. An algorithm was developed for predicting high-risk BCCs preoperatively with a sensitivity of 81.4% and a specificity of 53.3%. Study IV was a prospective pilot study assessing the feasibility of hyperspectral imaging using supervised learning of a convolutional neural network to preoperatively delineate the lateral margins of high-risk BCCs prior to MMS. Hyperspectral imaging achieved a pixel-wise classification accuracy of 0.76, a sensitivity of 0.75, a specificity of 0.78, and an area under the receiver operating characteristic curve of 0.84.

In conclusion, the results of this thesis contribute to an expanded understanding of the factors affecting treatment outcomes for high-risk BCC. Better preoperative diagnostics, such as clinical and dermatoscopic findings, are needed to correctly identify high-risk BCC candidates for MMS instead of undergoing incomplete excisions due to traditional surgery. This knowledge ensures that patients receive the most effective treatment from the start. Preoperative margin delineation using hyperspectral imaging could potentially decrease the number of MMS stages required and, in situations where MMS is not an option, it may help reduce the need for additional surgeries in traditional surgery.

Keywords: Basal cell carcinoma, dermoscopy, interobserver agreement, Mohs micrographic surgery, algorithm, incomplete excision, non-melanoma skin cancer, risk factors, hyperspectral imaging.

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