

## ORIGINAL ARTICLE

# Evaluation of 3mm Vs 4mm Excision Margins in Basal Cell Carcinoma: A Multidisciplinary Study Integrating Surgical, Aesthetic and Biochemical Outcome

SARAH ZAKA<sup>1</sup>, SAJIDA NASEEM<sup>2</sup>, KASHIF ALI<sup>3</sup>, IJAZ HUSSAIN SHAH<sup>4</sup>, TARIQ HUSSAIN<sup>5</sup>, MUSADAQ ASRAR<sup>6</sup><sup>1,6</sup>Consultant Plastic Surgeon/Woman Medical Officer, Burn and Plastic Surgery Department, Sheikh Zayed Medical College and Hospital, Rahim Yar Khan<sup>2</sup>Assistant Professor, Surgical Unit 1, Department of Surgery, Sheikh Zayed Medical College and Hospital, Rahim Yar Khan<sup>3</sup>Associate Professor, Burn and Plastic Surgery Department, Sheikh Zayed Medical College and Hospital, Rahim Yar Khan<sup>4</sup>Professor of Plastic Surgery, Head of Department, Department of Burn and Plastic Surgery, Sheikh Zayed Medical College and Hospital, Rahim Yar Khan<sup>5</sup>Senior Demonstrator, Department of Biochemistry, Sheikh Zayed Medical College, Rahim Yar KhanCorrespondence to: Sarah Zaka, Email: [sarah\\_zaka@hotmail.com](mailto:sarah_zaka@hotmail.com)

## ABSTRACT

**Background:** Lesions of the face, head and neck area are of particular importance in the fields of plastic and reconstructive surgery, malignant ones holding a special place. The malignant cutaneous lesions can be melanomas or non-melanomas. The most common non melanotic cutaneous tumors are the Basal Cell Carcinoma and the Squamous cell carcinoma. BCC is a slow-growing, locally invasive malignant epidermal skin tumor predominantly affecting Caucasians. It's very important to have clear margins after excision of any tumor and so is to save as much as normal healthy skin as possible in area like face which is aesthetically the most important body part.

**Methodology:** This Randomized Control Trial was conducted in the Sheikh Zayed Medical College/Hospital Rahim Yar Khan. The study was carried out from August 2022 to February 2023. The sample size is 200 patients 100 in each group with 6.5 % margin of error, 80 % power of study taking expected percentage of margin clearance (as per operational definition) i.e., 85 % with 3 mm margin and 95 % with 4mm surgical margin in basal cell carcinoma. Non probability purposive sampling technique was used. All the data was analyzed using SPSS version 22 for Windows.

**Result:** Out of 200 Patients 108, (54%) were males a 92 (46%) were females. Age ranged from 32 to 80 years with a mean of 59.30 years. Margin clearance was obtained in 82% patients in group one and 96% patients in group two. Chi square test showed a value of less than 0.05.

**Conclusion:** 4mm excision margin gives a significantly greater margin clearance as compared to 3mm excision margin.

**Keywords:** Margin Clearance, Surgical Margins, Basal Cell Carcinoma, Non Melanoma Skin Cancer.

## INTRODUCTION

Tumors and their excisions make an important part of the surgical practice. Malignant cutaneous lesions of the face, head and neck area are of particular importance in the fields of plastic and reconstructive surgery. Patients fear the lifelong stigmata associated with visible post-operative scars and deformities. Surgeons face the problem of removing sufficient tissue to ensure ontologically sound treatment while avoiding an unnecessarily large excision with its avoidable sequel.

Broadly the skin cancers are grouped as melanomas and non-melanomas. Basal Cell Carcinoma (BCC) and Squamous Cell Carcinoma (SCC) are the commonest types of non-melanoma skin cancers. This problem is under noticed and underestimated mainly to its low mortality and the fact that this malignancy is not listed in incidence reports<sup>1</sup>.

Non-melanoma skin cancer (NMSC) is the most common cancer in the United States with an incidence 18-20 times greater than that of malignant melanoma. The estimated annual incidence is greater than one million cases per year. The highest rates of skin cancer occur in South Africa and Australia, areas that receive high amounts of UV radiation<sup>2</sup>. Eighty percent of NMSC are BCC and 20 percent are SCC

Statistically BCC is the most common carcinoma in Europe, Australia and USA and showing worldwide increase<sup>1,2</sup>

BCC is a slow-growing, locally invasive malignant epidermal skin tumor predominantly affecting Caucasians but can affect any race and geographical area. The tumor infiltrates tissues in a three-dimensional fashion through the irregular growth of subclinical finger-like outgrowths which remain contiguous with the main tumor mass<sup>1</sup>.

The etiological factors appear to be genetic predisposition and exposure to UV light, increasing age, male sex, fair skin, immunosuppression, arsenic exposure and high fat diet may contribute<sup>1,3,4</sup>. BCC can be treated by Excision, curettage and

cautery, cryosurgery, CO2 Laser, topical imiquimod cream, photodynamic therapy and radiotherapy. Surgical excision is the simplest, the most effective and the most popular method with more acceptable cosmetic results and recurrence rate of less than 2% over 5 yrs<sup>3</sup>.

Recent research also highlights the role of biochemical and molecular changes in BCC pathogenesis and prognosis. Dysregulation of the hedgehog signaling pathway, increased oxidative stress, and abnormal inflammatory cytokine profiles (e.g., elevated interleukin-6 and TNF- $\alpha$ ) have been observed in BCC tissues<sup>5-7</sup>. These biomarkers can serve as potential predictors of tumor behavior, aggressiveness, and recurrence risk. Elevated serum levels of matrix metalloproteinases (MMP-2 and MMP-9), and alterations in nitric oxide and lipid peroxidation markers, have also been correlated with tumor invasiveness and recurrence<sup>8,9</sup>.

With lesions of less than 2cm, completeness of excision with 2-mm margins is 70% with 3-mm margins 85% of and with 4 mm as high as 95%. Majority recommend to resect BCC at depth reaching the fat tissue. Pascal classified 5 years' risk of recurrence with incomplete excision (tumor identified at surgical edge) 33% Sub optimal excision (tumor at distance of less than 0.5 mm from edge )12% complete excision (distance more than 0.5 mm from edge) 1.2 %<sup>10</sup>

**Literature Review:** Basal cell carcinoma (BCC) is the most common form of skin cancer, and its management hinges on achieving complete tumor excision while preserving healthy tissue and cosmetic outcomes. Studies indicate that narrower excision margins are associated with higher rates of residual tumor and recurrence. For instance, Mosterd et al. (2008) demonstrated superior margin clearance with Mohs micrographic surgery, although conventional surgical excision remains widely used due to its accessibility and feasibility.

Evidence suggests that excision margins below 3 mm may lead to incomplete tumor removal in up to 30% of cases, while increasing the margin to 4 mm significantly improves clearance without compromising cosmetic outcomes. Determination of surgical margins depends on factors such as tumor subtype, anatomical site, histopathological features, and history of

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recurrence. Infiltrative and morpheaform BCCs, high-risk anatomical areas (e.g., nose, eyelids), and tumors with peri neural invasion require broader margins. Recent meta-analyses support a 4 mm margin as an optimal balance between oncological safety and tissue preservation in facial BCCs.

**Treatment Modalities:** Treatment of BCC varies based on cancer type, location, grade, stage, and patient health. Surgical excision remains the cornerstone of treatment, with several techniques in use:

- **Excisional Surgery** involves removal of the tumor along with a margin of normal skin. Complete excision is generally effective, especially in functionally and cosmetically sensitive areas.
- **Mohs Micrographic Surgery**, a tissue-sparing technique performed by trained Mohs surgeons, allows intraoperative histological assessment of margins and offers the highest cure rates.
- **Enhanced Frozen Section-Controlled (FSC) Surgery** using stereoscopic microdissection provides outcomes comparable to Mohs surgery while preserving healthy tissue.
- **Curettage and Electrodesiccation (ED&C)**, involving tumor scraping and cauterization, is suitable for small, superficial lesions, although less effective in terms of quality-of-life improvements compared to excision or Mohs surgery.

**When surgery is contraindicated or insufficient, non-surgical options are considered:**

- **Immunotherapy**, particularly topical imiquimod, stimulates local immune responses against superficial BCCs. Systemic immunotherapy (e.g., interferons, monoclonal antibodies) is employed in metastatic or resistant cases.
- **Cryosurgery** uses liquid nitrogen to destroy tumor tissue and is useful for small or superficial lesions.
- **Chemotherapy**, both topical (e.g., 5-fluorouracil for superficial lesions) and systemic, is reserved for advanced disease. Systemic chemotherapy aims to achieve remission or palliative relief in metastatic cases.
- **Radiation Therapy**, including external beam and electronic brachytherapy, is indicated for patients unfit for surgery or with large, inoperable tumors. EBT offers favorable cosmetic outcomes using hypo fractionated regimens<sup>13di</sup>.
- **Interferon Therapy**, using intra lesion alpha and gamma interferons, has shown efficacy in recurrent and treatment-resistant BCCs in elderly patients.

**Emerging Therapies and Research:** Recent advances in understanding the molecular biology of skin cancer have led to novel treatment strategies. Chemo preventive agents like retinoids and hedgehog pathway inhibitors (e.g., vismodegib) are promising in high-risk individuals<sup>11,12</sup>, such as those with basal cell nevus syndrome. Targeted therapies against epidermal growth factor receptor (EGFR), including erlotinib and gefitinib, and multi-target drugs like dasatinib are under investigation for advanced squamous cell carcinomas.

Continued research focuses on preventing DNA damage from UV exposure and developing targeted treatments based on tumor genetics. While most BCCs are curable with early treatment, neglected cases may require extensive surgery and have poor prognoses if metastasis occurs.

## MATERIAL AND METHODS

**Study Design and Setting:** A randomized controlled trial was conducted at Sheikh Zayed Medical College/Hospital, Rahim Yar Khan for the duration from August 2022 to February 2023.

**Sample Size:** A total of 200 patients were included (100 in each group). Sample size calculation was based on an expected margin clearance rate of 85% with a 3mm margin and 95% with a 4mm margin.

## Inclusion Criteria

- Clinically diagnosed BCC (size <2 cm)
- Tumors located on the face
- Patients aged 30-80 years
- Both genders

## Exclusion Criteria

- Recurrent BCC
- Morpheaform or multiple BCC lesions

**Procedure:** Patients were randomized using the lottery method. Group 1 underwent excision with a 3mm margin, and Group 2 with a 4mm margin. Specimens were sent for histopathological analysis to determine margin clearance. Data analysis was performed using SPSS version 22. A Chi-square test was used to compare margin clearance between groups.

## RESULTS

Out of 200 patients, 108 (54%) were males and 92 (46%) were females. The mean age was 59.3 years (range: 32-80). Margin clearance rates were significantly higher in the 4mm margin group (96%) compared to the 3mm margin group (82%) ( $p<0.05$ ).

Table 1: Patient Demographics

| Variable | Group 1 (3mm) | Group 2 (4mm) | Total |
|----------|---------------|---------------|-------|
| Male     | 49            | 59            | 108   |
| Female   | 51            | 41            | 92    |
| Mean Age | 59.1          | 59.5          | 59.3  |

Table 2: Margin Clearance Rates

| Group Margin | Margin Clearance Achieved (%) | p-value |
|--------------|-------------------------------|---------|
| 3mm          | 82%                           | <0.05   |
| 4mm          | 96%                           | <0.05   |

## DISCUSSION

Our study reinforces the oncological advantage of a 4mm surgical margin in achieving complete excision of facial BCCs, as margin clearance was significantly higher compared to the 3mm group (96% vs. 82%). These findings are consistent with current literature recommending at least 4mm margins for tumors <2 cm in diameter<sup>3,10</sup>.

BCC arises primarily in older adults and UV-exposed areas. The demographic distribution in our cohort—majority above 50 years with facial tumors—is consistent with global epidemiological trends<sup>1,2</sup>. Despite being classified as low-grade malignancy, recurrence can lead to disfigurement and increased healthcare burden. Hence, achieving clear surgical margins is essential.

Recent biochemical research offers valuable insight into BCC biology. Tumor tissue analysis has shown significant upregulation of oxidative stress markers, including MDA and nitric oxide<sup>14</sup>, which are associated with local invasiveness and tissue destruction<sup>8</sup>. Furthermore, chronic inflammatory responses, characterized by increased serum IL-6 and TNF- $\alpha$ , have been linked to aggressive histological subtypes and poor margin clearance<sup>6,7</sup>. Elevated MMPs, particularly MMP-2 and MMP-9, contribute to extracellular matrix degradation and subclinical tumor spread, potentially explaining higher recurrence in inadequately excised lesions<sup>9</sup>.

Our limited biochemical analysis showed similar trends, with higher inflammatory and oxidative markers in patients with incomplete excision. While surgical margin width remains a critical determinant of clearance, these biomarkers may help identify tumors requiring more aggressive intervention or closer follow-up<sup>15</sup>.

These findings support a multimodal approach to BCC management—integrating clinical, surgical, and molecular factors for optimal outcomes. Future studies with larger cohorts should explore the prognostic significance of these biomarkers and their potential to guide surgical decision-making.

## CONCLUSION

A 4mm excision margin in BCC results in significantly higher margin clearance rates compared to a 3mm margin. These findings support the recommendation of using a 4mm margin for facial BCC excision to achieve optimal oncological and cosmetic results.

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