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Impact of Radiotherapy Waiting Time on Recurrence of Basal Cell Carcinoma: A Study at Dr. Soetomo General Hospital, Surabaya

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ABSTRACT

Basal cell carcinoma (BCC) is the most common skin cancer, often indolent but with a significant risk of local recurrence. Surgery remains the mainstay of treatment, while adjuvant radiotherapy is indicated for high-risk cases. Delayed initiation of radiotherapy may increase recurrence, yet evidence from Indonesia remains limited. This retrospective case–control investigation involved 62 patients with histopathologically verified basal cell carcinoma (BCC) treated at Dr. Soetomo General Hospital, Surabaya, from January 2017 to December 2023. All participants underwent wide local excision followed by adjuvant radiotherapeutic management. Relevant clinical parameters, including demographic characteristics, tumor features, radiotherapy latency, and recurrence status, were obtained from institutional medical records. Associations with recurrence were examined using the Chi-square test for categorical variables, the independent t-test for parametric data, and the Mann–Whitney U test for non-parametric distributions. Statistical significance was determined at $p < 0.05$. The majority of patients were female (54.8%) and aged 61–70 years (35.5%). The nasal region (H-zone) was the most common tumor site (38.7%), with mean tumor size of 4.0 ± 1.9 cm. Recurrence occurred in 31 patients (50%). Those with recurrence had significantly longer radiotherapy waiting times (mean 17.6 ± 12.2 months) compared with non-recurrence cases ($p < 0.001$). Larger tumor size was also associated with recurrence ($p = 0.034$). Tumor location within the H-zone showed a significant trend ($p = 0.021$), and high-risk histopathological subtypes were strongly predictive of recurrence ($p < 0.001$). No significant associations were found for sex ($p = 0.61$) or age ($p = 0.76$). Radiotherapy waiting time is a key modifiable factor influencing BCC recurrence. The need of early initiation of adjuvant radiotherapy, combined with optimal surgical margins and structured follow-up, is critical to reducing recurrence. These findings underscore the importance of timely treatment scheduling and warrant further research in Indonesian populations.

KEYWORDS: KSB, BCC, Extensive Excision, Radiotherapy Waiting Time, Recurrence Rate

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INTRODUCTION

Basal cell carcinoma (BCC) represents the most prevalent form of cutaneous malignancy, arising from the basal layer of the epidermis. Despite its typically indolent growth pattern and low metastatic propensity, BCC retains substantial clinical importance due to its capacity for extensive local invasion and a notable tendency toward recurrence [1, 2]. The condition predominantly manifests in the head and neck region, comprising approximately 85% of reported cases, and occurs more frequently among fair-skinned populations, particularly in males older than 40 years [3].

While BCC can usually be cured at an early stage, recurrence remains a major challenge. The five-year recurrence rate is approximately 10%, with two-thirds of cases occurring within the first three years after treatment [4]. Factors contributing to recurrence include inadequate excision margins, aggressive histological subtypes, larger or deeper tumors, difficult anatomical locations, delayed treatment, inappropriate treatment modalities, persistent UV exposure, as well as patient-related risk factors [5, 6]. Recurrence most often occurs on the face, especially the nose, and is associated with significant morbidity [7, 8].

Adjuvant radiotherapy is considered an effective modality for eradicating residual tumor cells following surgical excision [5]. However, its benefit is limited by long waiting times between histopathological confirmation and initiation of treatment. Delays in radiotherapy may contribute to higher local or regional recurrence rates and negatively affect patients' quality of life [9]. Research reported that the average waiting time for BCC patients was 54 days [10]. Given that recurrence has been documented within 11 to 86 months after surgery (mean 31.2 ± 19 months), such delays may further compromise outcomes [5].

Therefore, it is important to investigate the relationship between radiotherapy waiting time and recurrence in BCC patients. A better understanding of this association could improve postoperative management, enhance follow-up strategies, and ultimately optimize

clinical outcomes.

METHODS

This investigation utilized an observational analytic design with a retrospective case–control framework to examine the relationship between radiotherapy waiting time and recurrence among patients with basal cell carcinoma (BCC). The study encompassed all individuals diagnosed with BCC at Dr. Soetomo General Hospital, Surabaya, within January 2017 to December 2023.

The study sample consisted of patients with BCC who underwent wide surgical excision followed by postoperative radiotherapy at Dr. Soetomo General Hospital and met the eligibility criteria. The inclusion criteria were: (1) patients with histopathologically confirmed BCC who had undergone wide surgical excision; (2) patients who received postoperative radiotherapy; (3) patients aged 18–60 years; and (4) BCC located on the face. The exclusion criteria were: (1) incomplete medical records for the study variables, and (2) patients who died from causes unrelated to BCC.

Radiotherapy waiting time was delineated as the interval between histopathological verification following wide local excision and the commencement of radiotherapeutic intervention. Recurrence was defined as the emergence of a new lesion subsequent to wide excision and adjuvant radiotherapy, clinically manifested by localized erythema, induration, or ulceration at the prior excision site. Radiotherapy was administered using External Beam Radiation Therapy (EBRT) with a cumulative dose ranging from 40 to 80 Gy. The principal variables of interest comprised the latency period between histopathological confirmation and initiation of radiotherapy, as well as the incidence of BCC recurrence throughout the follow-up duration.

Data processing was conducted utilizing both descriptive and comparative analytical techniques with the aid of SPSS software version 23.0 for Windows. Descriptive statistics for the study variables were illustrated through tabulations, graphical representations, and cross-tabulations. For inferential analysis, associations between predictor variables and outcomes were examined using the Chi-square test, independent t-test, or Mann–Whitney U test, contingent upon the nature and distribution of the data. The t-test was employed to compare mean values between two groups for normally distributed continuous variables, whereas the Mann–Whitney U test served as the non-parametric alternative for data deviating from normality. A p-value of less than 0.05 was regarded as indicative of statistical significance.

RESULTS

Study Population

A total of 62 cases of basal cell carcinoma (BCC) were documented at Dr. Soetomo General Hospital, Surabaya, between January 2017 and December 2023. The cohort comprised predominantly female patients (54.84%), with males accounting for 45.16%. The nasal region represented the most frequent anatomical site of involvement (38.71%), followed by the supraorbital (16.13%) and buccal regions (11.29%). The highest incidence was noted among individuals aged 61–70 years (35.48%). The mean patient age was 67 ± 12.16 years, ranging from 32 to 94 years. The mean maximum tumor diameter measured 4.0 ± 1.90 cm, with sizes spanning from 1 cm to 8 cm. The average radiotherapy waiting interval was 17.55 ± 12.15 months, ranging from 3 to 62 months. Recurrence was observed in 50% of cases, whereas the remaining half exhibited no evidence of recurrence. The demographic and clinical characteristics of the study population are summarized in Table 1.

Table 1: Patient Characteristics

Variable	Recurrent (n)	Non-Recurrent (n)	Total	Percentage (%)
Sex				
Male	15	13	28	45.16%
Female	16	18	34	54.84%
Age Group (years)				
31–40	0	1	1	1.61%
41–50	3	1	4	6.45%
51–60	5	5	10	16.13%
61–70	12	10	22	35.48%
71–80	7	8	15	24.19%
81–90	4	5	9	14.52%
91–100	0	1	1	1.61%
Tumor Location				
Nasal	12	12	24	38.71%
Supraorbital	7	3	10	16.13%
Temporal	3	4	7	11.29%
Buccal	2	4	6	9.68%
Labial	2	2	4	6.45%
Palpebral	3	2	5	8.06%
Infraorbital	1	1	2	3.23%
Auricular	1	3	4	6.45%

Recurrence and Waiting Time for Radiotherapy

The relationship between recurrence and radiotherapy waiting time was evaluated using an independent t-test. Findings revealed that patients who experienced recurrence demonstrated a significantly prolonged interval before the initiation of radiotherapy, with a mean duration of 17.55 days (SD ±12.15, range 3–62), compared to those without recurrence ($p < 0.001$).

Table 2: Association Between Recurrence of BCC with Gender and Age

Variable	Recurrence (n=31)	%	Non-Recurrence (n=31)	%	Total (N=62)	%	p-value
Gender							0.61
Male	15	48.38	13	41.93	28	45.16	
Female	16	51.61	18	58.06	34	54.84	
Age Group							0.76
31–40 years	0	0.00	1	3.23	1	1.61	
41–50 years	3	9.68	1	3.23	4	6.45	
51–60 years	5	16.13	5	16.13	10	16.13	
61–70 years	12	38.71	10	32.26	22	35.48	
71–80 years	7	22.58	8	25.81	15	24.19	
81–90 years	4	12.90	5	16.13	9	14.52	
91–100 years	0	0.00	1	3.23	1	1.61	

Recurrence and Sex

The association between recurrence and sex was evaluated using the Chi-square test, as both variables were categorical in nature. The analysis demonstrated no statistically significant relationship between the two variables ($p = 0.61$). Among patients who experienced recurrence, 48.4% were male (15 of 31), while 51.6% were female (16 of 31), reflecting an approximately equal distribution by sex.

Recurrence and Age

The relationship between recurrence and age was analyzed using an independent t-test. The age distribution between the recurrence and non-recurrence groups showed no statistically significant difference ($p = 0.76$). Recurrence occurred most frequently among patients in their sixth decade of life (61–70 years, 35.5%), followed by those in the seventh decade (71–80 years, 24.2%). Nonetheless, the overall mean age did not differ significantly between patients with and without recurrence.

Table 3. Association Between Recurrence of BCC with Tumor Size, Location, and Subtype

Variable	Recurrence (n=31)	%	Non-Recurrence (n=31)	%	Mean ± SD	p-value
Tumor Size	–	–	–	–		0.034
Recurrence	–	–	–	–	4.5 ± 1.9	
Non-Recurrence	–	–	–	–	3.5 ± 1.7	
Tumor Location						0.21
H area	22	70.96	19	61.30	–	
M area	9	29.04	12	38.70	–	
Subtype						<0.001
High-risk	22	70.96	6	19.35	–	
Low-risk	9	29.04	25	80.64	–	

Recurrence and Tumor Size

Analysis of recurrence and tumor size was performed using the Mann–Whitney test due to non-normal distribution of tumor size data (Kolmogorov–Smirnov $p < 0.05$). The mean tumor size was significantly larger in patients with recurrence (mean 4.5 cm, SD ±1.9) compared with those without recurrence (mean 3.5 cm, SD ±1.7; $p = 0.034$).

Recurrence and Tumor Location

The association between recurrence and tumor location was analyzed using the Chi-square test. Tumor sites were categorized into high-risk, middle-risk, and low-risk anatomical areas. Recurrence occurred predominantly in high-risk locations (70.9%),

particularly in nasal and orbital regions, while 29.0% were in middle-risk areas and none in low-risk areas. A significant association was observed between recurrence and tumor location ($p = 0.021$).

Recurrence and Histopathological Subtype

Among the 62 cases, recurrence was further evaluated based on histopathological subtype. The subtypes were classified into high-risk (sclerosing, infiltrating, and basosquamous) and low-risk categories. Chi-square analysis demonstrated a statistically significant association between recurrence and histopathological subtype ($p < 0.001$). Recurrence was observed more frequently among patients with high-risk subtypes (22 cases, 70.9%) compared with those in the low-risk group (9 cases, 29.0%).

DISCUSSION

Basal cell carcinoma (BCC) is the most common type of non-melanoma skin cancer worldwide, with ultraviolet (UV) exposure being a major contributing factor to its rising incidence. The global incidence of BCC is estimated to increase by approximately 3% per decade, although epidemiological data in Indonesia remain scarce. Recurrence occurs in about 1%–20% of cases following surgical excision, often presenting with more aggressive features that complicate management [5,11]. In our hospital, recurrence was observed in 20% of patients within five years, consistent with previous reports highlighting key predictors such as surgical margin status, histopathological subtype, tumor size, depth of invasion, and UV exposure.

The majority of patients in this study were female (54.84%), with the highest age distribution between 61–70 years (35.48%), followed by those aged 71–80 years (24.19%), with a mean age of 67 years. The findings align with literature indicating that BCC incidence increases with age. Older males are generally at higher risk due to occupational sun exposure, whereas younger women (<40 years) may present more frequently due to increased awareness of skin health [11, 12]. However, in our study, neither sex ($p=0.61$) nor age ($p=0.76$) showed a statistically significant association with recurrence, which may be explained by the predominance of geriatric patients (>65 years) and multifactorial influences including tumor size, location, and treatment modality [12, 13, 14].

Tumor location was an important determinant of recurrence [15]. The nasal region (38.71%) was the most affected, categorized as part of the "H zone," an anatomical high-risk area due to surgical challenges and difficulty in achieving wide excision margins. Recurrence was significantly associated with tumor location ($p=0.021$), supporting earlier findings that lesions in the perinasal and periorbital regions carry worse prognoses due to higher rates of incomplete excision [5, 15, 16].

Tumor size also emerged as a significant factor, with recurrent cases having larger mean diameters (4.5 ± 1.9 cm) compared to non-recurrent cases (3.5 ± 1.7 cm, $p=0.034$). Larger tumors are known to harbor deeper invasion, perineural involvement, and aggressive histological features, all of which increase recurrence risk [1, 16]. Similarly, histopathological subtype played a crucial role: 70.96% of patients with high-risk subtypes (sclerosing, infiltrative, basosquamous) experienced recurrence, compared to only 29.04% of those with low-risk subtypes, yielding a highly significant association ($p<0.001$). These findings align with previous studies showing that high-risk BCC is strongly associated with perineural invasion and poorer clinical outcomes [1, 5].

Surgical excision with adequate margins remains the standard treatment for BCC, reducing both recurrence and metastasis. Furthermore, treatment delays before radiotherapy were strongly correlated with recurrence, with a mean waiting time of 17.55 ± 12.15 weeks ($p<0.001$). Prior studies support these findings, demonstrating that delays in treatment can increase tumor size and complexity, thereby worsening prognosis [17, 18, 19, 20]. A systematic review and meta-analysis further confirmed that for each month of radiotherapy delay, the risk of local recurrence increases significantly, particularly in head and neck cancers [22].

Unlike intrinsic tumor biology, waiting time is a modifiable factor, highlighting the importance of efficient scheduling and prioritization in cancer care. Delayed treatment not only increases recurrence risk but also complicates surgical management and worsens cosmetic outcomes, ultimately impacting patient survival and quality of life.

This study has several strengths, including its design, which retrospectively evaluated exposure factors while minimizing confounding variables through inclusion criteria. However, limitations must be acknowledged. The retrospective case–control design introduces selection bias and prevents prevalence estimation. Additionally, no standardized cut-off for recurrence was applied, limiting generalizability of findings within the Indonesian context. Future prospective studies are needed to validate risk factors, define recurrence thresholds, and further investigate the impact of radiotherapy timing on BCC recurrence.

CONCLUSION

In this study of 62 patients with basal cell carcinoma, the majority were female (54.8%) and within the 61–70 years age group (35.5%). The nasal region, particularly the high-risk "H zone," represented the most frequent tumor site (38.7%), with a mean tumor size of 4.0 ± 1.9 cm. Half of the patient experienced recurrence, and longer waiting time for radiotherapy (mean 14 ± 13.3 months) was significantly associated with recurrence. These findings underscore the importance of timely radiotherapy scheduling, careful surgical planning with adequate margins, and structured follow-up to reduce the risk of recurrence, while also emphasizing the need for further research to refine risk stratification in the local population.

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