Radiotherapy Treatment for Keloid Patients: A Retrospective Case Study in Sub-Saharan Africa

Emmanuel T. Andero[1*], Anthonia Sowunmi[1], Orimisan Belie[2], Adebayo Abe[3], Oluwadarasimi Ojediran[3]

[1]Department of Clinical & Radiation Oncology, Mbbs Fwacs Medserve-Luth Cancer Center. Lagos.

[2]Department of Plastic and Reconstructive Surgery, Mbbs Fwacs., Lagos University Teaching Hospital

[3]Department of Medical Physics, BSc MSc PhD., Medserve-Luth Cancer Center.

***Corresponding Author**

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ABSTRACT

Background: Keloid is an abnormal proliferation of scar tissue that extends beyond the boundaries of the original wound, commonly seen in individuals with darker skin. Hence this study seeks to investigate the radiotherapy treatment for keloid patients in sub-Saharan Africa.

Methodology: This retrospective study utilized data from both physical and electronic medical records at the NSIA-LUTH Cancer Centre, covering the period from May 2019 to January 2025. A total of 100 patients diagnosed with keloids during this time were reviewed. 73 keloid patients identified during the study period received radiotherapy (RT). Descriptive and inferential statistics, including Pearson correlation and Chi-square tests, were performed using SPSS version 27.0.

Results: Seventy-three patients with a mean age of 36.21 ± 13.72 years (range 15 - 84) were enrolled. More than half of the population 37 (50.7%) were female and 36 (49.3%) were male. Body mass index (BMI) showed that 15 (20.5%) were healthy weight, 13 (17.8%) each were overweight and obese. 14 (19.2%) reported a family history of keloids, and comorbidities were present in 6 (8.2%). Multiple site affectation were the commonest sites in 17 (23.3%) of cases and ear lobes accounting for 12 (16.4%). Recurrence was reported in 30 (41.1%) of patients. The most common causes of keloids in this population were injury and wound 11 (15.1%). The time elapsed between the onset of lesions and diagnosis was 10 years and above for most patients 20 (27.4%). 34 (46.6%) of patients had surgical excision. All patients were treated with electron beam therapy. Different RT dose regimens were applied in this study, including 12/4Gy 18 (25%), 12/3Gy 12 (16%), 9/3Gy 11 (15%), and 16/4Gy 9 (12%). There was a strong statistical significance between keloid recurrence and surgery ($r = 0.544$, $p < 0.001$).

Conclusion: This study highlights high incidence of keloids among young adults, especially females and rate of recurrence. This study dose regimens aligns with international best practices. There is a need for early detection of high-risk patients, combined therapy regimens, and tailored follow-up protocols to reduce recurrence.

Keywords: Keloid, Predisposing factors, Recurrence, Radiotherapy

INTRODUCTION

Keloids are an unwelcome and disfiguring consequence in the process of wound healing. They are fibroproliferative lesions formed from scar tissue while healing skin wounds (1). These lesions occur after injuries that penetrate the dermis, where fibroproliferation is integral to the healing process, unlike injuries that only affect the epidermis (2). Keloids form as hard, often nodular growths. They are distinguished by a growth pattern that extends beyond the original site of injury. This abnormal growth pattern is likely the result of an excessive fibroproliferative response to injuries in individuals genetically predisposed to developing keloids. The initial injury can be minor and often overlooked (2). However, keloids frequently arise from chronic inflammation caused by ear piercings, recurring trauma from shaving, burn injuries, insect bites, cuts, and surgical incisions (2, 3).

People of all races are affected by keloids even though some previous studies demonstrated that keloids disproportionately occur in specific groups of patients. However, limited studies show that younger patients are more prone to keloid formation (4). Evidence in India among 1000 patients showed that patients aged 10-30 years are more affected (4) while another study reported among 120 patients in Nigeria found that young adults are primarily affected (4). Various studies on keloid prevalence vary according to different countries, with estimates of 0.09% in England (4), 8.5% in Kenya (4), 0.1% in Japan (4), and 16% in Zaire (4). However, Nigeria reported an estimated incidence of 1.5 million in 2017 and about 36% of the figure accounted for by familial cases (5). Evidence from 402 patients living in Ghana, Australia, Canada, and England found that the prevalence of keloids was higher in the Ghanaian population. Another study reported a high rate of keloids in Chinese descent patients among 175 patients of Malaysian, Indian, or Chinese descent. A UK-based heterogeneous cohort study examined excessive scarring among 972 patients which reported prevalence rates of 1.1%, 2.4%, and 0.4% for Asian, Black, and White patients, respectively (4).

Evidence has shown that surgical excision is the most common therapeutic method. However, there is still a high recurrence rate of 50% within a year (6). Recently, postoperative adjuvant radiation therapy (RT) has been an effective method in decreasing the rate of keloid recurrence, especially brachytherapy (6). A randomized trial showed that patients undergoing surgery and adjuvant radiotherapy had less recurrence than patients undergoing cryotherapy and intralesional steroid injection and even a better safety profile (7). Previous studies showed that high-energy electron radiotherapy could provide a better dose distribution than kilovoltage X-rays for controlling keloids (7). Studies have explored different radiotherapy modalities, doses, and fractionation schedules to optimize outcomes. For example, electron beam radiation therapy (EBRT) using a dose of 10Gy fractioned for two days can effectively treat keloid earlobes, and 20Gy fractioned over four days should treat the chest, scapular region, and suprapubic region (8). Other studies reported a higher dose of 15Gy for earlobes keloids and cartilaginous part of the auricle keloids with minimal recurrence rates (8).

Despite the effectiveness of radiation therapy for keloid treatment, there is still a paucity of robust data from sub-Saharan Africa. Few single institutional studies have reported using low-dose RT protocols and recurrence rates (2). This gap in the literature is particularly observable given the high prevalence of keloid-prone individuals in this region, such as one conducted in Ibadan, which reported 14.5% recurrence rates among 175 cases with postoperative RT (9). This five-year retrospective study aims to evaluate the pattern and clinical documentation of keloid cases treated with radiation therapy in this region.

This study will contribute to the existing body of knowledge and also shape policy decision-making and evidence-based practice on keloid management in the sub-Saharan context.

METHODOLOGY

The Nigeria Sovereign Investment Authority-Lagos University Teaching Hospital Cancer Center (NSIA-LUTH Cancer Centre or NLCC) is a specialist cancer treatment facility, the seat of the medical and radiation oncology department of the teaching hospital. The center provides modern systemic and advanced conformal radiation therapy services in affiliation with in-hospital surgical services. NLCC is host to Nigeria's largest oncology workforce in a single center, equipped with 3 Linear Accelerators, modern radiotherapy treatment planning systems, and the only three-dimensional, high-dose-rate brachytherapy facility in the country, making it the bestequipped radiation oncology center in the sub-region Africa outside of South Africa. The center’s 10 consultant oncologists all sub-specialized in different cancer sites lead a larger team of medical and radiation physicists, radiation therapists, oncology nurses, and more. Surgical oncology has been established in the Lagos University Teaching Hospital for decades with a recent ramping up of surgical oncology investment underway.

This retrospective study utilized data from both physical and electronic medical records at the NSIA-LUTH Cancer Centre, covering the period from May 2019 to January 2025. A total of 100 patients diagnosed with keloids during this time were reviewed. 73 keloid patients identified during the study period received radiotherapy (RT). The diagnosis was based on clinical history and physical examination, while cases managed with surgical excision were confirmed histologically. Data collected included patient age, gender, ethnicity, body mass index (BMI), family history of keloids, comorbidities, site of affectation, recurrence, cause of keloid formation, disease duration, surgical intervention, previous treatments received, and radiation therapy modalities.

Descriptive statistics were used to summarize the demographic data, clinical features, medical history, and treatment modalities of the patients. Inferential statistics were conducted to assess the relationships between family history of keloids and clinical characteristics and medical history, as well as between keloid recurrence and these same variables. The Chi-square test was applied at a 95% confidence level, with a p-value of <0.05 considered statistically significant. All statistical analyses were performed using SPSS Statistics version 27.0.

RESULTS

Table 1 shows keloid patients' socio-demographic characteristics. The mean age at presentation was 36.21 ± 13.72 years (range 15 - 84). Out of 73 patients, 23 (31.5%) were within 20 – 29 years, and 2 (2.7%) were above 70. More than half of the population 37 (50.7%) were female and 36 (49.3%) were male. The most common ethnic groups were Yoruba 36 (49.3%) and Igbo 26 (35.6%), and the least common was Hausa 1 (1.4%).

Table 1 Socio-demographic Characteristics of Keloid Patients

Variables	**Frequency**	**Percentage**
Age range (years)		
10 – 19	7	9.6
20 – 29	23	31.5
30 – 39	15	20.5
40 – 49	18	24.7
50 – 59	4	5.5
60 – 69	4	5.5
≥ 70	2	2.7
Mean ± SD of Age (36.21±13.72)		

Table 2 demonstrates keloid patients' predisposing factors for keloid development. 14 (19.2%) reported a family history of keloids, and comorbidities were present in 6 (8.2%). A total of 18 sites (nose, ear lobe, ear, face, groin, scapula region, scalp, occipital, jaw, chest, neck, chin, breast, hand, abdominal area, cheek, pre-auricular, and pelvis) were affected, some patients 17 (23.3%) had multiple site affectation. Recurrence was reported in 30 (41.1%) of patients. The most common causes of keloids in this population were injury and wound 11 (15.1%), and the least common 1 (1.4%) were surgery and furuncle. The time elapsed between the onset of lesions and diagnosis was 10 years and above for most patients 20 (27.4%).

Table 2 Predisposing Factors for Keloid Development

Variables	**Frequency (n)**	**Percentage (%)**
Family History of Keloid	14	19.2
Comorbidities	6	8.2
Hypertension	6	8.2
Site of Affectation		
Nose	1	1.4
Ear lobe	12	16.4
Ear	10	13.7
Face	5	6.8
Multiple body sites	17	23.3
Groin	1	1.4
Scapula region	1	1.4
Scalp	1	1.4
Occipital	1	1.4
Jaw	3	4.1
Chest	2	2.7
Neck	5	6.8
Chin	1	1.4

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Breast	1	1.4
Hand	1	1.4
Abdominal region	1	1.4
Cheek	2	2.7
Pre-auricular	1	1.4
Pelvis	1	1.4
Recurrence	30	41.1
Etiology		
Injury & wound	11	15.1
Ear-piercing	8	11
Trauma	4	5.5
Surgery	1	1.4
Furuncle	1	1.4
Shaving	2	2.7
Disease Duration		
0–5 years	13	17.8
6–9 years	3	4.1
≥10 years	20	27.4

Among the 37 (50.7%) of patients who underwent, 34 (46.6%) had an excision and 1 (1.4%) underwent incision and drainage. Other treatments, include intralesional injections 14 (19%), cream 2 (2.7%), and cryotherapy 1 (1.4%). All patients in this population were treated with electron beam therapy (100%). The most frequently utilized dose regimen was 12/4 Gy 18 (25%), followed by 12/3 Gy 12 (16%), 9/3 Gy 11 (15%), and 16/4 Gy 9 (12%).

Table 3 Treatment Modalities of Keloid Patients

Variables	Frequency	Percentage
Surgery	37	50.7
Excision	34	46.6
Incision and drainage	1	1.4
Radiotherapy		
Electron Beam Therapy	73	100
Other Treatment		
Intralesional Injections	14	19
Cryotherapy	1	1.4
Cream	2	2.7
Dose Regimen (Gy)		
8/2	6	8.2
10 / 2	3	4.1
12 / 3	12	16
9 / 3	11	15
15 / 3	1	1.4
18 / 3	1	1.4
21 / 3	1	1.4
12 / 4	18	25
20 / 4	1	1.4
16 / 4	9	12
8 / 4	2	2.7
15 / 5	2	2.7
30 / 6	1	1.4
6 / 6	1	1.4
20 / 20	1	1.4
Mean ± SD (12.25±3.74)		

Table 4 examines the relationship between keloid recurrence and some predisposing factors and surgery. There was a strong statistical significance between keloid recurrence and surgery ($r = 0.544$, $p < 0.001$). There was also a positive significant ($p<0.05$) correlation between keloid recurrence and site of affectation, keloid history, comorbidities, and etiology. Age and disease duration did not show a statistically significant relationship with recurrence.

Table 4 Relationship between Keloid Recurrence and Some Variables of Keloid Patients

Variables	**Pearson Correlation**	**Sig.**
Recurrence – Age	0.142	0.231
Recurrence – Keloid History	0.374**	0.001
Recurrence – Comorbidities	0.354**	0.002
Recurrence – Site Affectation	0.300*	0.014
Recurrence – Etiology	0.382**	<0.001
Recurrence – Disease duration	0.223	0.058
Recurrence - Surgery	0.544**	<0.001

Table 5 evaluated the relationship between a family history of keloid and predisposing factors and surgery. There was a strong significance between family history of keloid and comorbidities ($r = 0.724$, $p < 0.001$). There was also a positive significant ($p<0.05$) correlation between family history of keloid and etiology, disease duration, and surgery. Furthermore, there was no significant relationship between family history and age or site of affectation.

Table 5 Relationship between Family History of Keloid and Some Variables of Keloid Patients

Variables	**Pearson Correlation**	**Sig.**
Family history of keloid – Age	0.004	0.976
Family history of keloid– Comorbidities	0.724**	<0.001
Family history of keloid– Site Affectation	0.056	0.654
Family history of keloid– Etiology	0.373**	0.001
Family history of keloid– Disease duration	0.407**	<0.001
Family history of keloid- Surgery	0.355**	0.002

DISCUSSION

All patients in this study treated with RT underwent Electron Beam Therapy (EBT) as the ionizing radiation for postoperative keloid treatment, representing 100% of RT cases. This demonstrates a strong institutional preference for EBT, often attributed to its capacity for accurately targeting skin lesions such as keloids while sparing surrounding tissues (7). However, there is evidence that postoperative radiotherapy, particularly when administered within the first 24 to 72 hours following excision, substantially reduces recurrence rates, (7, 13). This was reported by Ketiku et al, where a new method of treatment of keloid was compared with an old technique (13). This study is also consistent with Shen et al (7), who documented the application of hypofractionated EBT for 568 keloid cases in China. Liu and Yuan (1) noted that all keloid patients treated between 2011 and 2017 received EBT. Different RT dose regimens were applied in this study, including 12/4Gy (25%), 12/3Gy (16%), 9/3Gy (15%), and 16/4Gy (12%). Abdus-salam et al (9) reported that 99.4% of keloid patients in Ibadan were treated with 12/2Gy. Another Chinese study documented the use of 18/2Gy for hypofractionated electron-beam therapy in keloid patients. The dose regimens in this study are consistent with the recommendations of Zainib and Amin (3) (12 to 20 Gy and 3 to 4 fractions daily at 3 to 4 Gy per fraction) for keloid radiotherapy.

In this study, surgery in general accounted for 50.7%, surgical excision for 46.6%, and incision & drainage (1.4%) cases in this population. These findings are consistent with standard clinical practice where excisional surgery remains a first-line therapy for large or symptomatic keloids (3). However, it has been documented that surgical excision alone has a high recurrence rate varying from 45 – 100%, especially without adjuvant treatment (9). The correlation study also showed a moderately strong positive correlation between surgery and recurrence of keloid ($r = 0.544$), indicating that patients who were managed with surgical excision were more likely to experience

recurrence. The correlation was highly statistically significant ($p < 0.001$), which suggests that the relationship is unlikely to have occurred by chance. This corroborates with current literature that has reported high recurrence rates with surgery, frequently in excess of 45–70%, especially in the absence of adjuvant treatment like radiotherapy (3, 4).

The patients in this study had an age range from 15 to 84 years, with an average age of 36.21±13.72 years and a median age of 34. The most common (31.5%) age group of patients was between 20 – 29 years, followed by 24.7% within the 40 – 49 years range. Abdus-salam et al. (9) found 42.4% of the patients were in the 20- to 29year age group in Ibadan, while Kouotou et al. (10) noted that 69.6% of the patients were more than 25 years of age in Yaoundé, Cameroon. Research indicated that keloids are more commonly seen within 10 – 40 years of life (5), observed in this study. Other studies have noted an increased prevalence of keloids in the age group reported here. Olasode and Bello (14) reported that 35.1% of patients were between 20 and 29 years of age in South West Nigeria, whereas, in the other study conducted in Calabar, 53.64% were of the same age group (15).

More than half (50.7%) of the study population were females and 49.3% accounted for males. Isamah et al(2) found 54.1% of the patients were female in Southern Nigeria, while Kouotou et al (10) noted that 54.9% were female in Cameroon. Previous literature has indicated that women are more prone to keloid development.

Women are also concerned about their beauty and are more often preoccupied with the negative esthetic impact that keloid may cause. However, they are more prone to consult. On the contrary, Anaba et al (16) documented a male preponderance, which accounted for 56% of their population. However, it was theorized that male preponderance was probably due to the high prevalence of trauma as the cause of the keloid in their population. Another study conducted in Ibadan (9) reported that 57% of the patients were male, while multiple lesions were found to be more prevalent in women in Jamaican (4).

A family history was noted in 19.2% of patients, which included the father, mother, brother, sister, and grandmother in this study. Isamah et al (2) reported that 25% of patients had a family of keloids in Southern Nigeria, while another research indicated that 43% of patients had familial keloids (10). Persons with a family history of keloids are four times more likely to develop keloids and eight times more prone to experience keloids at multiple sites, highlighting a significant genetic underpinning factor in the occurrence of keloids (5). The formation of keloids has been associated with genetics as the condition has been shown to run in families (5).

Among patients with a site of affectation documented, the most common sites were multiple body sites (23.3%), the earlobe (16.4%), and the ear (13.7%). These findings indicate a relatively high burden of extensive or multiregional keloid involvement, which may suggest a systemic or genetic predisposition among the affected population (5). The predominance of the earlobe and ear as the frequent sites of keloid development align with the findings of Isamah et al (2), who reported the earlobe as the most common site (35%) in their study. Similarly, a study in Ibadan documented the ear as the most affected site in 35% of the patients (9), highlighting the vulnerability of ear areas – often linked to damage from piercings or injuries (10). However, anatomical sites of keloids vary significantly according to geography and population. Kouotou et al (10) identified presternum as the commonest site (26.5%) in Cameroon. This is consistent with anterior chest involvement as the commonest site in Ile-Ife, Nigeria (14), and chest involvement accounted for 25.5% of cases seen in a US-based study (4). These findings suggest that the upper chest region is particularly prone to keloid formation and hypertrophic scarring due to its elevated skin tension and intermittent traumatization (3,10).

This research recorded a marginally greater occurrence of females (50.7%) compared to males (49.3%). Isamah et al (2) reported that females made up 54.1% of participants in Southern Nigeria, while Kouotou et al (10) identified an even higher female prevalence of 54.9% in Cameroon. Additionally, Swenson et al (4) found that 65.9% of the population in the USA were females, whereas Anaba et al (16) noted a male dominance with 56% in their Lagos study. Furthermore, Olasode and Bello (14) observed that females constituted 65% of the population in South West Nigeria. The higher percentage of females may be attributed to their greater sensitivity towards beauty or physical appearance, leading them to be more often focused on the potential negative aesthetic effects that keloids can create (10).

The common causes of keloids in this study were Injury & wound (15.1%), ear piercing (11%), and trauma (5.5%). These findings align with local and regional studies that identify skin trauma as a significant factor for keloid

formation (11). Consistent with this, ear piercing was predominant in Southern Nigeria (32.4%) (10), highlighting the cultural prevalence of ear decoration and auricular skin vulnerability to hypertrophic scarring. Furthermore, Kouotou et al (10) indicated that wounds accounted for 38% of cases in Cameroon, which may explain the relationship between wound healing and keloid pathogenesis among the Black Populations. Belie et al (17) identified trauma (27%) and acne (20.1%) as the most common causes of keloid in their study. Evidence demonstrated that poorly treated or manipulated acne can predispose to chronic inflammation and the formation of excessive scar tissue, especially in adolescents with active sebaceous glands (18).

CONCLUSION

This study found high incidence of keloids in young adults, particularly females, and support was found for the significant contribution of genetic predisposition and site-related determinants to disease expression and recurrence. Notably, surgery remains the most common modality of management, but its strong association with recurrence highlights the limitations of excision alone and suggests the value of adjunct therapies, in particular radiotherapy. All patients in this study who had radiation therapy were given electron beam therapy, reflecting institutional preference towards its precision in the management of superficial tumors. The heterogeneity of dose regimens aligns with international best practices. The positive correlation of recurrence with comorbidities, etiology of keloids, family history, BMI, and site of involvement suggests keloid recurrence is a multifactorial process and should be treated with individualized and multidisciplinary management. In addition, the close correlation between family history and several clinical parameters, including disease duration and comorbidities, supports the impression that genetic and systemic influences are important in keloid behavior and treatment response. There is a need for early detection of high-risk patients, combined therapy regimens, and tailored follow-up protocols to reduce recurrence.

Statements and Declarations

This study is an original work and is the fruit of various researchers contributing in various capacities.

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Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

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