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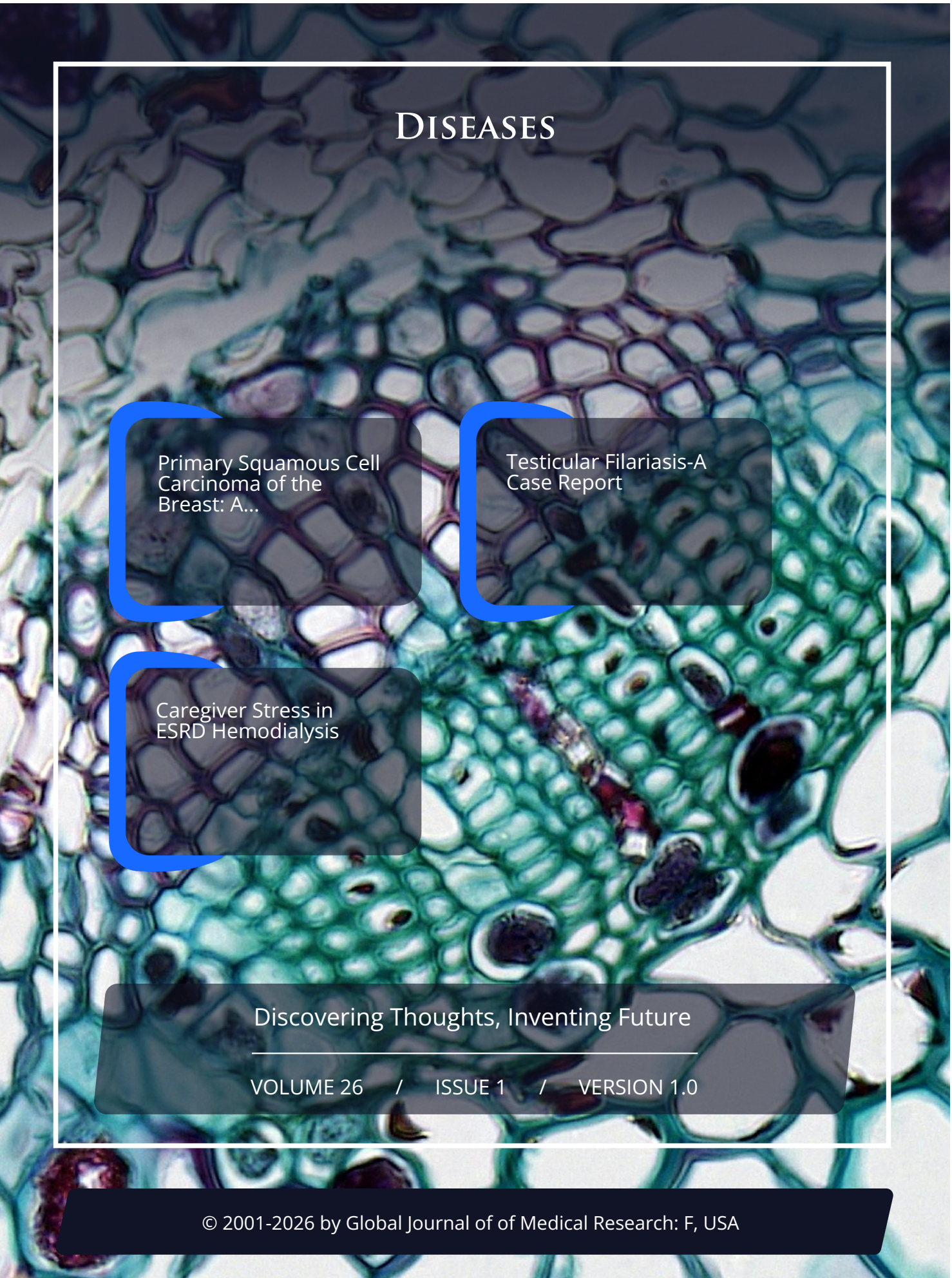

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Global Journal of Medical Research

Preface

The Global Journal of Medical Research (GJMR) is pleased to present this issue, bringing together a curated collection of high-quality research papers that explore the latest advances in medical science and clinical practice.

This issue features research spanning topics including neurology, pharmacology & drug discovery, microbiology & pathology, radiology & diagnostics, gynecology, diseases, veterinary science, orthopedics, surgery & cardiovascular medicine, dentistry, nutrition, and interdisciplinary medical studies. Each paper has undergone a rigorous double-blind peer-review process to ensure clinical rigor and scientific originality.

We would like to express our sincere gratitude to the authors for entrusting their research with us, to the reviewers for their thorough and constructive evaluations, and to our readers for their continued engagement with the medical scientific discourse.

We hope that the research presented herein inspires further inquiry and contributes meaningfully to the advancement of medical knowledge and patient care.

The Chief Editor
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Primary Squamous Cell Carcinoma of the Breast: A Rare Case Report

Article Record

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Abstract

Primary squamous cell carcinoma (SCC) of the breast is a rare type of cancer, representing between 0.06% and 0.2% of malignant breast tumors. The disease presents with rapid growth and an aggressive pattern, and the lack of well-defined therapeutic protocols hinders its treatment. The following is a case report of a 64-year-old patient referred due to the appearance of a nodule in her left breast with progressive growth. On physical examination, she presented with a large breast mass (>10 cm) and palpable axillary lymph nodes. Core biopsy identified the lesion as poorly differentiated carcinoma, staged as T4d N1 Mx (inflammatory). The patient was referred for neoadjuvant chemotherapy with paclitaxel and carboplatin, but experienced tumor progression during chemotherapy and was referred for a hygienic mastectomy. The histopathological result showed an invasive carcinoma with squamous differentiation, grade 3, ulcerated with invasion of the pectoral muscle and free margins (pT4b pNx pMx). Only after immunohistochemistry was it confirmed that it was, in fact, a keratinizing squamous cell carcinoma (SCC). Postoperatively, the patient returned with signs of surgical wound dehiscence and pleuropulmonary and mediastinal metastatic progression. After multidisciplinary and family discussion, exclusive palliative care was instituted. Primary SCC of the breast presents with an aggressive clinical picture and a challenging diagnosis, requiring histopathological and immunohistochemical confirmation. The gold standard of treatment includes surgery with free margins, but there is no consensus regarding adjuvant chemotherapy. The prognosis is guarded, especially in locally advanced or metastatic cases

primary breast carcinoma | rare breast neoplasms | squamous cell carcinoma of the breast

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Primary Squamous Cell Carcinoma of the Breast: A Rare Case Report

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Abstract

Primary squamous cell carcinoma (SCC) of the breast is a rare type of cancer, representing between 0.06% and 0.2% of malignant breast tumors. The disease presents with rapid growth and an aggressive pattern, and the lack of well-defined therapeutic protocols hinders its treatment. The following is a case report of a 64-year-old patient referred due to the appearance of a nodule in her left breast with progressive growth. On physical examination, she presented with a large breast mass (>10 cm) and palpable axillary lymph nodes. Core biopsy identified the lesion as poorly differentiated carcinoma, staged as T4d N1 Mx (inflammatory). The patient was referred for neoadjuvant chemotherapy with paclitaxel and carboplatin, but experienced tumor progression during chemotherapy and was referred for a hygienic mastectomy. The histopathological result showed an invasive carcinoma with squamous differentiation, grade 3, ulcerated with invasion of the pectoral muscle and free margins (pT4b pNx pMx). Only after immunohistochemistry was it confirmed that it was, in fact, a keratinizing squamous cell carcinoma (SCC). Postoperatively, the patient returned with signs of surgical wound dehiscence and pleuropulmonary and mediastinal metastatic progression. After multidisciplinary and family discussion, exclusive palliative care was instituted. Primary SCC of the breast presents with an aggressive clinical picture and a challenging diagnosis, requiring histopathological and immunohistochemical confirmation. The gold standard of treatment includes surgery with free margins, but there is no consensus regarding adjuvant chemotherapy. The prognosis is guarded, especially in locally advanced or metastatic cases

Keywords: *primary breast carcinoma, rare breast neoplasms, squamous cell carcinoma of the breast*

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1. Introduction

Non-melanoma skin cancer is a significant public health problem, with an incidence increasing by 4% to 8% annually in developing countries[1]. Of new cancer cases registered, approximately 20% are located in the skin, making it the most frequent type of cancer in the world[2]. Primary squamous cell carcinoma (SCC) of the breast is considered a very rare malignant neoplasm, with an estimated prevalence between 0.06% and 0.2% of breast neoplasms[2,3]. Its occurrence is not well established, but it may be related to squamous metaplasia of the ductal epithelium or even originate from alterations during embryonic development[4]. Squamous cell carcinoma (SCC) presents rapid progression and a high invasive and metastatic potential when compared to basal cell carcinoma. Because it is an extremely rare neoplasm in the breast region, its clinical diagnosis becomes challenging[2].

According to the literature, the prevalence of SCC is associated with white women, ranging from 52 to 64 years of age[3]. Pure squamous cell carcinoma of the breast can originate from the epidermis, nipple, or even the epithelium of a deep epidermoid cyst or squamous metaplasia[5]. When it occurs in the breasts, the lesion can mimic breast cancer, with a desquamative and erythematous clinical presentation, of an irregular and verrucous lesion[2]. It is classified by the World Health Organisation (WHO) as a specific and distinct subtype of metaplastic tumour and presents the following criteria: 90% or more of the lesion composed of keratinising squamous cell carcinoma infiltrating mammary parenchyma; absence of other invasive neoplastic elements; no extensive involvement of the skin overlying the tumour and absence of primary neoplastic skin lesions[3].

In addition to its rarity, this carcinoma generally has a poor prognosis due to its aggressive nature and the lack of specific treatments, as there is no established protocol for it[3]. Core biopsy and immunohistochemistry are used for its diagnosis[4]. Any lesion that presents a clinical suspicion should be rigorously evaluated, with early biopsy requested to ensure an accurate diagnosis and avoid unnecessary radical therapies[2].

Regarding treatment, there is no consensus on the best clinical approach, but chemotherapy remains one of the options used. The chemotherapy regimen with cisplatin and fluorouracil has been described as an excellent option, with reasonable responses reported after its use[4]. However, surgical removal of the lesion remains the treatment of choice (gold standard), as it allows for complete histopathological examination of the tumour, evaluation of surgical margins, and assessment of prognostic factors such as perineural invasion. In cases of excision of small tumors, where the surgical margins are clear, i.e., 4 mm to 10 mm from the lesion, the cure rate is estimated at almost 99%[2].

Therapeutic approaches should be analysed and planned on a case-by-case basis, taking into account the patient's particular factors and preferences. Advanced cases of breast squamous cell carcinoma (SCC) may require mastectomy with axillary lymphadenectomy combined with adjuvant chemotherapy. However, in cases of primary breast SCC, removal with wide surgical excision is recommended, with lymph node dissection only necessary when there is

clinical evidence of axillary spread. Histopathological confirmation, along with immunohistochemical evaluation and clinical history, is fundamental for the correct diagnosis of this rare type of tumour[2].

Therefore, the rarity of this case, its diagnostic difficulty, and the uncertainties regarding the best treatment to be instituted justify the writing of this article.

2. Case Report

Female patient, 64 years old, black race, G3P3C0A0, menarche at age 15, menopause at age 53, with no prior use of hormone replacement therapy. She reported being a chronic smoker, with no other reported comorbidities or relevant family history.

The patient was referred to the Mastology Service with a history of a palpable nodule in the left breast, associated with progressive growth. On physical examination, the left breast was larger than the right, due to a large nodule in the left breast, measuring more than 10 cm, associated with an ulcerated lesion, local skin thickening, and the presence of palpable lymph nodes in the ipsilateral axillary region (Figure 1).

Regarding the complementary exams, the patient brought a recent mammogram, classified as BIRADS 3 (Breast Imaging Reporting and Data System), which described a solid, hypoechoic, oval nodule with circumscribed margins, located at the junction of the medial quadrants of the left breast, measuring 4,5 x 4,0 x 4,3 cm.

In light of the clinical findings, a core biopsy of the lesion guided by ultrasound was requested, whose anatomopathological examination revealed a poorly differentiated, solid carcinoma. Immunohistochemistry revealed a triple-negative pattern, with negative estrogen receptor (ER), progesterone receptor (PR), and human epidermal receptor (HER2) and a proliferation antigen (Ki-67) of 70%.

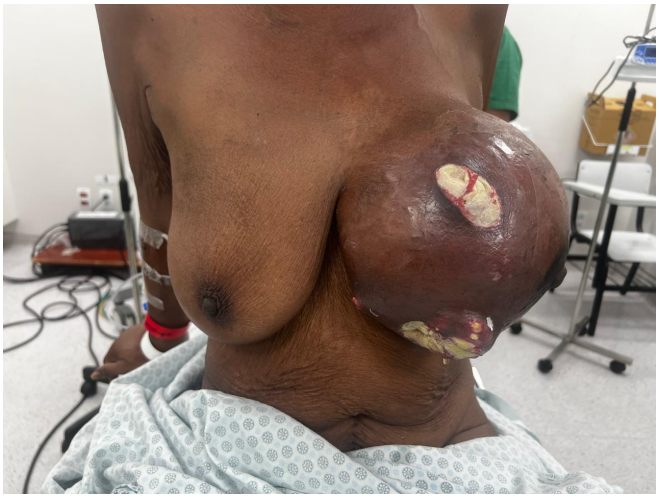


Figure 1. Physical examination showing a large tumor lesion in the left breast, with significant distension and ulceration of the skin, with associated secretion.

Source: author's own.

The chest CT scan showed a small solid subpleural nodule in the posterior basal segment of the left lower lobe, measuring 0.7 x 0.7 cm, suggestive of secondary pleuropulmonary involvement. Breast ultrasound showed a heterogeneous nodular formation, difficult to measure, occupying the entire left mammary parenchyma, associated with the presence of ipsilateral axillary lymphadenopathy, measuring 2.6 x 1.2 cm, which is atypical. Both bone scintigraphy and abdominal tomography were negative for secondary lesions.

Due to the size of the lesion, the patient was referred to the Oncology Service for neoadjuvant chemotherapy. Treatment with paclitaxel and carboplatin was chosen because this combination is widely recommended and used in advanced cases of breast and gynecological neoplasms and, as neoadjuvant chemotherapy, significantly increases the complete pathological response. However, after four cycles with this weekly protocol, the patient showed a poor response and significant tumour progression and was then submitted to hygienic mastectomy surgery.

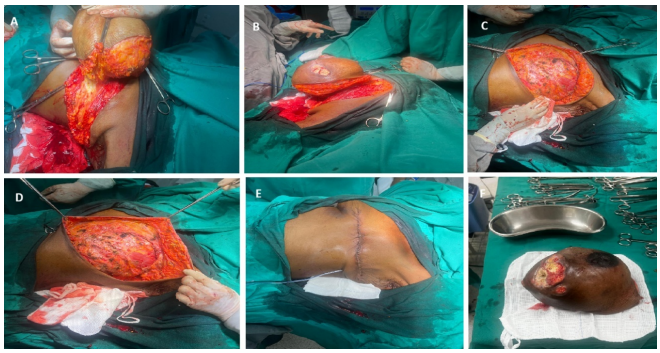


Figure 2. Radical mastectomy of the left breast, Halsted type (A, B and C). Intercostal muscle, without the pectoralis major muscle, is already excised (D). Final closure with skin suture and Portovac drain (E). Final view of the surgical specimen (left breast).

Source: author's own.

The histopathological examination revealed invasive carcinoma with squamous differentiation, ulcerated, grade 3, measuring 17.0 x 12.0 x 10.0 cm, with focal angiolymphatic invasion, infiltration of the pectoral muscle and free margins (pT4b pNx pMx) (Figure 3).

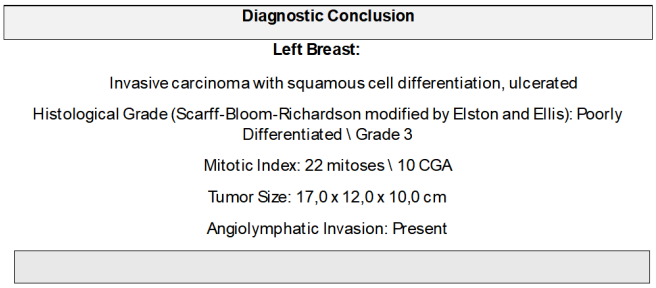
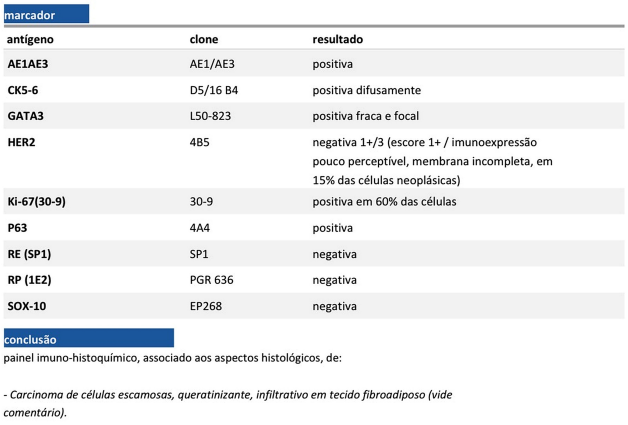


Figure 3. Histopathological examination of the surgical specimen showed invasive carcinoma with Ulcerated Squamous Cell Differentiation.

Source: author's own.

Only after performing immunohistochemistry on the surgical specimen was the diagnosis of keratinising squamous cell carcinoma (SCC) definitively confirmed (Figure 4).

In the immediate postoperative period, the patient developed dehiscence of the surgical wound, in addition to disease progression in the anterior mediastinum and pleura. The case was discussed with the Clinical Oncology and Radiotherapy teams, and it was decided to perform palliative radiotherapy in the anterior hemithorax, followed by capecitabine as a second-line treatment. Upon conducting a new chest CT scan for therapeutic planning, a mass was found in the sternal region, with a significant increase in tumour volume. The adoption of exclusive palliative care was discussed with the patient and her family, and it was agreed that no further interventions would be performed.



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antígeno	clone	resultado
AE1AE3	AE1/AE3	positiva
CK5-6	D5/16 B4	positiva difusamente
GATA3	L50-823	positiva fraca e focal
HER2	4B5	negativa 1+/3 (escore 1+ / imunoexpressão pouco perceptível, membrana incompleta, em 15% das células neoplásicas)
Ki-67(30-9)	30-9	positiva em 60% das células
P63	4A4	positiva
RE (SP1)	SP1	negativa
RP (1E2)	PGR 636	negativa
SOX-10	EP268	negativa

conclusão

painel imuno-histoquímico, associado aos aspectos histológicos, de:

- Carcinoma de células escamosas, queratinizante, infiltrativo em tecido fibroadiposo (vide comentário).

Figure 4. Immunohistochemistry panel confirming the diagnosis of keratinising squamous cell carcinoma.

Source: author's own.

3. Discussion

Primary squamous cell carcinoma of the breast is very rare, with a prevalence of 0.06% to 0.2% in malignant breast neoplasms[2,3]. It is called primary pure squamous cell carcinoma when the malignant cells are all of the squamous cell type, there is no relation with the skin, and if there is no indication for a primary location somewhere else in the body[5]. Furthermore, it has a rapid and aggressive course, with a recurrence rate of 25% and metastasis in 50% of cases[3,6]. SCC typically progresses rapidly and is highly invasive, most frequently found on exposed body surfaces most frequently seen in the sun and is uncommon in the breasts[2].

For a more accurate diagnosis, it is essential to differentiate between squamous cell carcinoma (SCC) of the skin and primary squamous cell carcinoma of the breast, which differ in their epidemiology and histopathology. The former is more prevalent in black individuals and in males, and its most common clinical manifestation is an erythematous-squamous or slightly raised plaque. Furthermore, it can present as an ulcerated lesion with irregular borders or as an exophytic nodular lesion, similar to that presented in the case described[6]. The latter is prevalent in white women and may originate from the epidermis, nipple, or even the epithelium of a deep epidermoid cyst or squamous metaplasia[3,5]. It is important to distinguish this type from mixed tumours, where some patches of squamous cells can be found in adenocarcinoma of the breast and from metastasis of squamous cell carcinoma that originated elsewhere. The etiology and pathogenesis of squamous cell carcinoma of the breast is still unclear. It has been suggested that it may be a very extreme form of squamous cell metaplasia, developing into an adenocarcinoma[7].

The clinical presentation may be painful breast inflammation or a tumor that is always larger than that of breast adenocarcinoma, similar to that found in the case described[8].

Regarding imaging studies, there are no typical findings on mammography, and ultrasound may show a complex cyst or an inflammatory process[5]. In our case, mammography showed only one solid, hypoechoic nodule with circumscribed margins, located at the junction of the medial quadrants of the left breast, measuring 4,5 cm. The patient did not undergo breast ultrasound. It is still debatable whether investigations such as PET scans, in search of distant metastases or a primary squamous tumour site, should be performed[9].

For a more precise diagnosis, a core needle biopsy should be performed, as it provides a greater amount of material (tissue) to be analysed[6]. Regarding the diagnosis, immunohistochemical examination should always be performed, as it allows confirmation of the squamous nature of the tissue and differentiation from other types of breast carcinomas, such as metaplastic carcinoma[5]. This differentiation is of great importance, as primary squamous cell carcinoma of the breast behaves more aggressively than other breast cancers[5].

Squamous cell carcinoma of the breast may require surgery with wide excision to obtain clear margins, as occurred in the reported case[2]. Regarding lymph node dissection, it should only be indicated when there are signs of axillary invasion, either clinically or by ultrasound[2].

Treatment is not specific due to the lack of an established protocol; however, one possible treatment involves adjuvant hormonal therapy with tamoxifen, which is essential when patients are positive for estrogen and progesterone receptors[3]. Squamous cell carcinomas are generally hormone receptor-negative[8,10]. For patients with negative expression of these receptors, conventional chemotherapy is necessary, as used in the aforementioned case[5].

Postoperative chemotherapy should be recommended and, similar to other cases reported in the literature, the combination of paclitaxel and carboplatin appears to be the best option currently[5]. This chemotherapy regimen is used in advanced cases of breast, ovarian, and lung cancer. Both cisplatin and carboplatin interact with DNA, inhibiting cell growth (paclitaxel) and damaging tumor DNA (carboplatin), with a high rate of pathological complete response when used in neoadjuvant chemotherapy[11]. They have a mechanism of action similar to bifunctional alkylating agents, destroying rapidly dividing tumor cells[12].

Regarding radiotherapy, it is recommended to administer it as adjuvant therapy, however the radiosensitivity of squamous cell carcinomas is still uncertain. The 5-year survival rate is around 67%[13].

Therefore, primary squamous cell carcinoma of the breast is an uncommon finding. Its existence and possible evolution from an apparently benign lesion remain uncertain. For its definitive diagnosis, we emphasize the importance of histopathological examination and immunohistochemistry. Regarding treatment, the role of surgery is well established, but the role of adjuvant therapy is not yet well defined[5].

In this particular case, the patient began treatment with neoadjuvant chemotherapy, showing a poor response with disease progression, and subsequently underwent radical breast surgery due to the size of the initial lesion, with clear surgical margins. Despite all the treatment instituted and due to the aggressive nature of the neoplasm, the patient soon experienced significant mediastinal recurrence, considered inoperable, and was referred for palliative and supportive care.

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Testicular Filariasis-A Case Report

Article Record

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Abstract

Filariasis is a parasitic infection endemic to tropical and subtropical regions. The disease primarily affects the body's lymphatic system. In India, heavily infected areas with filariae are found in Orissa, Uttar Pradesh, Bihar, Andhra Pradesh, Tamil Nadu, Kerala, and Gujarat.[1]Genital filariasis in India more commonly presents as a secondary vaginal hydrocele with an associated epididymo-orchitis.[2] While testicular involvement is rare, the clinical manifestations of filariasis vary from person to person, depending on the course of infection and the worm load. It is very uncommon to find an adult worm in the testis.

filariasis hydrocele testis torsion

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Testicular Filariasis-A Case Report

Dr. Aruna Packirisam[§], DR. Abhilasha Wahne[§], Dr. Jeewan Verma[§], and Dr. Anil kumar verma[§]

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Abstract

Filariasis is a parasitic infection endemic to tropical and subtropical regions. The disease primarily affects the body's lymphatic system. In India, heavily infected areas with filariae are found in Orissa, Uttar Pradesh, Bihar, Andhra Pradesh, Tamil Nadu, Kerala, and Gujarat.[1]Genital filariasis in India more commonly presents as a secondary vaginal hydrocele with an associated epididymo-orchitis.[2] While testicular involvement is rare, the clinical manifestations of filariasis vary from person to person, depending on the course of infection and the worm load. It is very uncommon to find an adult worm in the testis.

Keywords: *filariasis, hydrocele, testis, torsion*

DOI: 10.34257/GJMRFVOL26IS1PG5

Key Clinical Message

A 21 year old male presented with Right hydrocele with pain in Right hemi scrotum which was diagnosed clinically and radiologically as torsion and subjected to orchidectomy. Histopathology revealed filariasis. The case has been presented for its rarity.

1. Introduction

Filariasis is a parasitic infection endemic to tropical and subtropical regions. The disease primarily affects the body's lymphatic system. In India, heavily infected areas with filariae found in Orissa, Uttar Pradesh, Bihar, Andhra Pradesh, Tamil Nadu, Kerala, and Gujarat. [1] Genital filariasis in India more commonly presents as a secondary vaginal hydrocele with an associated epididymo-orchitis. [2] While testicular involvement is rare, the clinical manifestations of filariasis vary from person to person, depending on the course of infection and the worm load. It is very uncommon to find adult worm in the testis.

2. Case History

A 21-year-old young man presented with a history of pain and swelling in the Right hemiscrotum for 3–4 days with a history of trauma to scrotal area due to a fall 7–8 days back.

On examination, a tense cystic swelling of Rt hemiscrotum, firm in consistency, and a firm cord in consistency were found. USG examination of Rt testis was done and reported as Rt hematocele with Rt testicular torsion.

3. Treatment and Histopathology

Patient underwent a right orchiectomy. The specimen was sent for histopathological examination in 10% formalin. On examination, the entire right testis was dark brown. Histopathological examination showed a scanty rim of testicular tissue with extensive area of hemorrhage and necrosis, adult filarial worm surrounded by dense inflammatory cell infiltration of neutrophils, lymphoplasmocytes, and eosinophils were seen. No significant pathology was detectable in the epididymis or spermatic cord. A histopathological diagnosis of right-sided filarial orchitis was given.

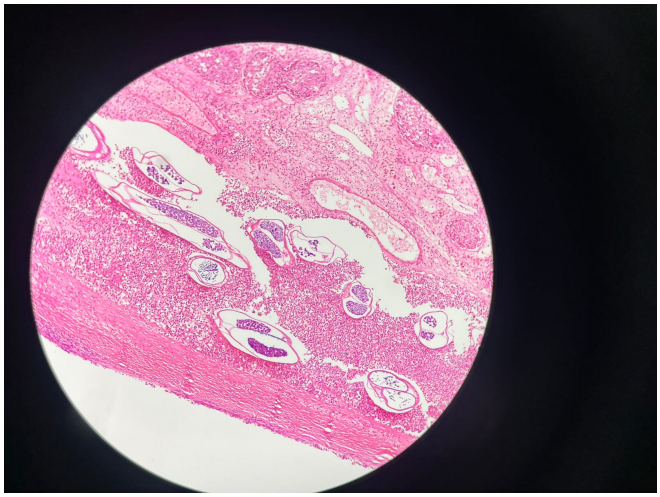

Figure 1. Female adult filarial worm in testicular parenchyma (H&E stain, 100X)

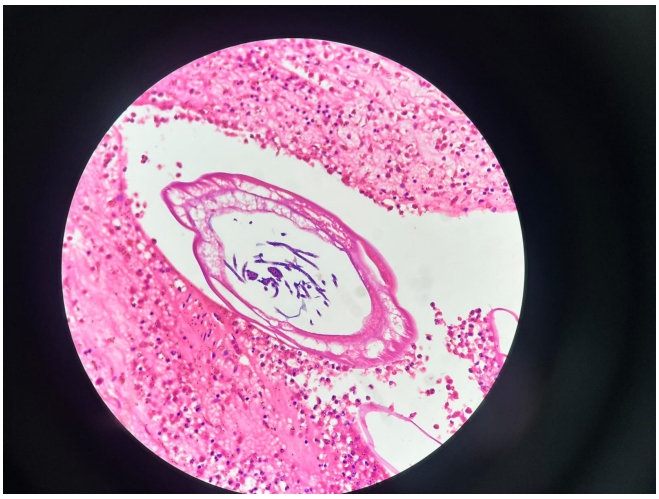

Figure 2. Double-barrel uterus of female adult filarial worm with microfilariae seen against the background of mixed inflammatory infiltrate (H&E stain, 400X)

4. Discussion

The filarial orchitis simulates grossly with neoplastic and non-neoplastic testicular and paratesticular lesions that include non-specific orchitis, tuberculous epididymo-orchitis, malignant mesothelioma, adenomatoid tumors, mesothelioma cyst and reactive mesothelioma hyperplasia, malakoplakia, sarcoidosis, and inflammatory pseudotumor. [3]

The filarial infection is prevalent in both urban and rural areas. Adult worms are found in the lymphatic vessels and lymph nodes of humans only; there is no animal reservoir. Adult worms in the lymphatic channels produce clinical manifestations of the disease due to lymphatic dysfunction, obstruction, and inflammation. Genital bancroftian filariasis may manifest in several ways including hydrocoele, lymph varix, lymph scrotum, filarial penis or elephantiasis of the genitalia, and chyluria. Hydrocoele accounts for 90% of the morbidity due to genital filariasis. Diagnosis of genital filariasis can be confirmed by direct demonstration of microfilaria in blood or aspirated fluid unequivocally. The tools available for the detection of active infection in an amicrofilaremic patient are circulating filarial antigen (CFA) tests and ultrasound with a high-frequency probe showing filaria dance sign (FDS). [4] This case report highlights an unusual presentation of genital filariasis where intense congestion of the testis and epididymis with microfilaria resulted in acute scrotum masquerading as testicular torsion.

5. Conclusion

Filarial orchitis may simulate clinically with many neoplastic and non-neoplastic lesions. The various differential diagnoses must be kept in mind when dealing with testicular swellings, especially in endemic areas, to avoid unnecessary orchidectomy.

AUTHOR CONTRIBUTION

All the authors contributed equally to the preparation of this manuscript.

CONSENT

Written informed consent could not be obtained in this case as the patient was lost to follow-up. Institutional ethical committee approval was obtained after declaring that the case report does not contain any patient identifiers.

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Evaluating Stress among Family Caregivers of Hemodialysis Patients with End-Stage Renal Diseasef

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Abstract

Background: Chronic kidney disease (CKD) is a progressive condition leading to end-stage renal disease (ESRD), often requiring hemodialysis. Hemodialysis imposes significant physical and psychological demands not only on patients but also on family members, who serve as primary caregivers. High caregiver stress can adversely affect both caregiver well-being and patient outcomes.

Objectives: This study aimed to assess the level of stress among family members of patients undergoing hemodialysis and to examine its association with socio-demographic and patient related factors.

Methods: A descriptive cross-sectional design was employed involving 120 family caregivers at a selected hospital in Gazipur, Dhaka. Data were collected using a structured socio-demographic questionnaire and the Kingston Caregiver Stress Scale. Descriptive statistics summarized caregiver characteristics and stress levels, while Chi-square and t-tests assessed associations with selected variables.

Results: Findings revealed that $74.2%$ of caregivers experienced severe stress, $25%$ moderate stress, and $0.8%$ low stress. Stress levels were significantly associated with age, gender, family type, marital status, income, area of residence, and patient condition severity. Younger caregivers, males, those from nuclear families, and caregivers of patients with severe illness reported higher stress.

Conclusion: Family caregivers of hemodialysis patients experience substantial stress influenced by multiple socio-demographic and patient-related factors. Integrating targeted interventions, including counseling, educational programs, and social support, into routine hemodialysis care is essential to reduce stress, enhance caregiver well-being, and improve patient outcomes.

caregiver stress | hemodialysis | end-stage renal disease | family caregivers | bangladesh

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Evaluating Stress among Family Caregivers of Hemodialysis Patients with End-Stage Renal Diseasef

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Keywords: *caregiver stress, hemodialysis, end-stage renal disease, family caregivers, bangladesh*

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1. INTRODUCTION

Chronic kidney disease (CKD) is a progressive, irreversible condition characterized by a gradual decline in kidney function, ultimately leading to end-stage renal failure (ESRD), which requires renal replacement therapies such as hemodialysis (HD) or kidney transplantation for survival (Cao, Chen, Liu, Wu, & Gao, 2025). CKD has emerged as a major global public health challenge, with prevalence rising due to aging populations, lifestyle changes, and increasing rates of diabetes and hypertension (Cao et al., 2025). In Bangladesh, CKD incidence is particularly concerning, with many patients affected by comorbidities and limited access to specialized care (Kar & Islam, 2023; Fatemaa et al., 2025). For most ESRD patients in low- and middle-income countries, hemodialysis remains the most accessible and life-sustaining treatment (Kar & Islam, 2023).

Hemodialysis is the most commonly used treatment for kidney failure. It is a procedure in which a dialysis machine and a special filter—also known as an artificial kidney or dialyzer—are used to remove waste products and excess fluids from the blood when kidney function is impaired. The number of individuals undergoing hemodialysis is increasing each year. This time-intensive and expensive therapy imposes both physical and psychosocial stress, creating a significant burden on patients and their families (George, Zaidi, & Kazmi, 2022). Hemodialysis is often considered a "family illness," with family caregivers serving as essential partners in the therapeutic process. Caregivers frequently prioritize the needs of patients over their own, spending less time on health-promoting activities, which adversely affects their own health and disrupts their daily routines (Ebadi, Sajadi, Moradian, & et al., 2021).

While life-saving, hemodialysis imposes substantial physical and psychological demands on patients. Common physiological challenges include fatigue, anemia, vascular access complications, and cardiovascular comorbidities (Hejazi, Hosseini, Ebadi, & et al., 2021). Patients must also adhere to strict dietary and fluid restrictions, frequent hospital visits, and lengthy dialysis sessions multiple times per week (George, Zaidi, & Kazmi, 2022). These challenges extend to family members, who act as informal caregivers and bear significant responsibility in ensuring treatment adherence, monitoring complications, and providing emotional and practical support (Ebadi, Sajadi, Moradian, & et al., 2021).

Family caregivers play a pivotal role in ESRD management, yet caregiving is often associated with high levels of stress and reduced quality of life (QoL) (Akbari, Farsi, & Sajadi, 2023; Pio, Prihanto, Jahan, Hirose, Kazawa, & Moriyama, 2022). In South Asia, family caregiving is strongly influenced by cultural expectations, with emotional bonds and familial obligations promoting close involvement in patient care (Khouban-Shargh, Mirhosseini, Ghasempour, & et al., 2024). While this involvement can improve patient outcomes, it frequently leads to psychological and social burdens, including

anxiety, depression, and social isolation, adversely affecting both caregiver well-being and the quality of care provided (Akbari et al., 2023; George et al., 2022; Pio et al., 2022).

Caregiver burden encompasses both objective and subjective dimensions. Objective burden refers to tangible disruptions such as time constraints, reduced social interactions, and physical strain, while subjective burden involves emotional and psychological responses, including stress, frustration, and feelings of inadequacy (Ebadi et al., 2021). Evidence indicates that caregiver stress intensifies as patients' disease progresses or as treatment complexity increases, potentially leading to burnout and reduced caregiving capacity (Khouban-Shargh et al., 2024; Al Maqbali, Al Omari, Abu Sharour, & et al., 2025). In Bangladesh, financial challenges, limited access to renal replacement therapy, and inadequate healthcare infrastructure exacerbate caregiver stress, creating a unique burden for family members (Fatemaa et al., 2025; Kar & Islam, 2023).

Perceived stress reflects a caregiver's appraisal of their ability to manage caregiving demands. High levels of perceived stress are associated with anxiety, depression, and decreased QoL (Khouban-Shargh et al., 2024; Al Maqbali et al., 2025; George et al., 2022). Stress often has reciprocal effects: as patients experience physical or emotional distress, caregiver stress increases, which can negatively impact patient care and outcomes (Ebadi et al., 2021; Hejazi et al., 2021). Studies in Indonesia and Iran report that family caregivers of hemodialysis patients commonly experience moderate to high levels of stress, highlighting the global relevance of this issue (Pio et al., 2022; Khouban-Shargh et al., 2024).

Stress management and social support are key factors in mitigating caregiver stress. Structured programs that focus on adaptive coping strategies, problem-solving, relaxation techniques, and emotional regulation can significantly reduce perceived stress and enhance QoL and caregiving effectiveness (Khouban-Shargh et al., 2024; Al Maqbali et al., 2025). Social support from family, friends, or community networks reduces perceived stress, improves coping, and strengthens caregivers' ability to provide effective patient care (George et al., 2022; Pio et al., 2022).

Despite growing awareness of caregiver stress, research specifically focusing on family caregivers in low- and middle-income countries, including Bangladesh, remains limited. Local evidence suggests caregivers face unique challenges due to insufficient healthcare resources, financial constraints, and social pressures (Kar & Islam, 2023; Fatemaa et al., 2025). Understanding the prevalence and determinants of stress among caregivers is therefore essential for designing culturally appropriate interventions that enhance both caregiver well-being and patient outcomes.

ESRD and hemodialysis impose considerable psychological and social demands on family caregivers. High levels of stress among caregivers negatively affect QoL and caregiving capacity (Akbari et al., 2023; Khouban-Shargh et al., 2024; George et al., 2022; Pio et al., 2022). Addressing caregiver stress through structured interventions and strong social support networks is crucial for holistic ESRD management, particularly in resource-limited settings like Bangladesh. This study aims to assess the level of stress among family caregivers of patients undergoing hemodialysis and identify contributing factors to guide interventions that improve caregiver and patient outcomes.

2. MATERIALS AND METHODS

2.1. Research Approach

A quantitative research approach was adopted to systematically examine the stress levels experienced by family members of patients with end-stage renal failure undergoing hemodialysis. This approach facilitated the collection of numerical data that could be statistically analyzed, allowing for objective measurement and reliable conclusions regarding caregivers' stress.

2.2. Research Design

A descriptive cross-sectional design was employed to provide a snapshot of the stress levels and coping mechanisms among family members at a specific point in time. This design enabled the study to explore and describe the experiences and challenges of patients in the hemodialysis unit.

2.3. Sample

The study population comprised family members of patients undergoing hemodialysis at a selected Hospital in Gazipur, Dhaka. The accessible population included family members present during the data collection period who consented to participate. Using a non-probability convenience sampling technique, a total of 120 participants were selected.

2.4. Criteria for Sample Selection

Inclusion Criteria: The study included family members who accompanied patients during hemodialysis and provided essential support. Participants were required to be present during the data collection period and be aged 25 years or older.

Exclusion Criteria: Family members who were not directly related to the patient, such as friends or extended relatives, were excluded. Additionally, those who were unwilling to participate, unable to read or write in Bangla, absent during the data collection period, or younger than 25 years were not considered for the study.

2.5. Tool for Data Collection

Data were collected using a structured questionnaire consisting of two sections. Section A gathered socio-demographic information, including age, gender, education, occupation, relationship to the patient, and other relevant characteristics. Section B employed the Kingston Caregiver Stress Scale (KCSS), a standardized 10-item instrument designed to assess caregiver stress. Each item was rated on a 5-point Likert scale, where 1 indicated "No Stress" and 5 indicated "Extreme Stress." Total scores ranged from 10 to 50 and were categorized as Low Stress (10–20), Moderate Stress (21–30), High Stress (31–40), and Extreme Stress (41–50). The KCSS was validated and culturally adapted into Bangla for use in this study to ensure clarity and appropriateness for participants (Sadak et al., 2017; García-Martínez et al., 2021).

2.6. Data Collection Procedure

After obtaining ethical approval and hospital permission, participants were approached in the waiting area of the hemodialysis unit. The researcher explained the study purpose, obtained informed consent, and provided the structured questionnaire. Participants completed the self-administered questionnaire in 15–20 minutes, with clarification provided as needed.

2.7. Data Processing and Analysis

Data were coded and analyzed using descriptive statistics (frequency, percentage, mean, standard deviation) for demographic variables. Inferential statistics, specifically the Chi-square test, were employed to assess associations between stress levels and selected socio-demographic variables. Study findings were presented in tables and graphs (bar charts and pie charts).

2.8. Ethical Considerations

The study adhered to the principles of the Declaration of Helsinki and received ethical clearance from the Institutional Ethical Review Board (IERB) of selected institution (Approval No: EMC/IERB/2024/10-17, October 29, 2024). Participants were provided with detailed information sheets and consent forms indicating the purpose, methods, and voluntary nature of the study. The participation was risk-free to the participants, and confidentiality and anonymity were guaranteed at all stages of the study. In addition, institutional clearance was also obtained from the study site prior to data collection.

3. RESULTS

Table 1 reveals that most family members accompanying patients with end-stage renal failure undergoing hemodialysis were aged 20–30 years (31.7%), followed by those aged 41–50 years (27.5%) and 31–40 years (24.2%), with 16.7% aged 51 years and above. Slightly more than half were male (53.3%), and the majority were married (65.8%) and Muslim (81.7%). High school education was most common (31.7%), and housewives formed the largest occupational group (28.3%), followed by private employees (16.7%) and government employees and farmers (12.5% each). Most participants belonged to joint families (59.2%) and were spouses of the patients (45.0%). Family income was fairly distributed, with 31.7% earning above BDT 20,001. Participants predominantly resided in rural areas (42.5%), followed by semi-urban (37.5%) and urban areas (20.0%). The majority were always present with the patient (41.7%), and most patients' conditions were of moderate severity (60.0%).

Table 2 reveals that the majority of family members of patients with end-stage renal failure undergoing hemodialysis experienced severe stress, accounting for 74.2% of the sample. A smaller proportion reported moderate stress (25.0%), while only 0.8% of participants experienced low stress. This indicates that most family members face a high level of psychological burden while caring for patients undergoing hemodialysis.

Table 3 reveals that stress levels among family members of patients undergoing hemodialysis were significantly associated with age, gender, and occupation. Severe stress was most prevalent across all age groups, particularly among participants aged 31–40 years (24.2%) and 20–30 years (22.5%). Gender differences were also evident, with a higher proportion of males (45.8%) experiencing severe stress compared to females (28.3%), while moderate stress was slightly higher among females (17.5%) than males (7.5%). Occupation showed a significant association with stress, with severe stress being more common among private employees (14.2%) and government employees (5.8%), whereas moderate stress was observed mainly among government employees (6.7%). These findings indicate that age, gender, and occupation are important factors influencing the psychological burden of family members caring for patients undergoing hemodialysis.

Table 4 reveals that mean stress scores among family members of patients undergoing hemodialysis differed significantly across several selected variables. Age was significantly associated with stress ($F = 9.69$, $p < 0.01$), with the highest mean stress observed in the 31–40 years group (36.89 ± 3.00) and the lowest in those aged 51+ years (30.55 ± 3.73). Gender also showed a significant difference ($t = 2.51$, $p = 0.01$), with males (34.60 ± 5.45) having slightly higher stress than females (34.44 ± 3.00). Family type influenced stress levels significantly ($t = 5.46$, $p < 0.01$), with participants from nuclear families (36.12 ± 3.58) experiencing higher stress than those from joint families (31.85 ± 4.58).

Table 1. Distribution of Demographic Variables among Family Members (N = 120)

Demographic Variable	Category	n	%
Age (years)	20–30	38	31.7
	31–40	29	24.2
	41–50	33	27.5
	51 and above	20	16.7
Gender	Male	64	53.3
	Female	56	46.7
Marital Status	Unmarried	38	31.7
	Married	79	65.8
	Others	3	2.5
Religion	Islam	98	81.7
	Hindu	17	14.2
	Christian	4	3.3
	Buddhist	1	0.8
Level of Education	No formal education	19	15.8
	Primary school	30	25.0
	High school	38	31.7
	Collegiate	33	27.5
Occupation	Government employee	15	12.5
	Private employee	20	16.7
	Retired	9	7.5
	Farmer	15	12.5
	Daily worker	8	6.7
	Student	12	10.0
	Businessperson	7	5.8
	Housewife	34	28.3

Table 2. Distribution of Stress Levels among Family Members (N = 120)

Level of Stress	n	%
Low	1	0.8
Moderate	30	25.0
Severe	89	74.2

Table 3. Association between Stress Levels and Socio-Demographic Variables

Demographic Variable	Low Stress n (%)	Moderate Stress n (%)	Severe Stress n (%)	χ^2	p-value
Age (years)				19.1	<0.01
20–30	1 (0.8)	10 (8.3)	27 (22.5)		
31–40	0	0	29 (24.2)		
41–50	0	10 (8.3)	23 (19.2)		
51+	0	10 (8.3)	10 (8.3)		
Gender				10.79	<0.01
Male	0	9 (7.5)	55 (45.8)		
Female	1 (0.8)	21 (17.5)	34 (28.3)		
Occupation				24.41	0.04
Govt. Employee	0	8 (6.7)	7 (5.8)		
Private Employee	1 (0.8)	2 (1.7)	17 (14.2)		
Others	—	—	—		

Table 4. Comparison of Stress Levels by Selected Variables

Variable	Category	Mean Stress Score	SD	df	F/t	p-value	CI
Age	20–30	33.36	5.45	3	9.69	<0.01	—
	31–40	36.89	3.00				
	41–50	32.81	3.82				
	51+	30.55	3.73				
Gender	Male	34.60	5.45	—	2.51	0.01	0.45–3.87
	Female	34.44	3.00				
Family Type	Nuclear	36.12	3.58	—	5.46	<0.01	2.71–5.80
	Joint	31.85	4.58				
Marital Status	Married	32.73	4.54	2	6.55	<0.01	—
	Unmarried	35.68	4.44				
	Others	30.00	1.73				
Monthly Income	5001–10000	34.28	4.09	3	5.23	<0.01	—
	10001–15000	36.21	3.45				
	15001–20000	31.51	5.77				
	Above 20001	33.32	3.97				
Area of Residence	Rural	32.66	4.82	2	5.66	<0.01	—
	Semi-Urban	35.37	4.31				
	Urban	32.25	4.15				
Patient Condition	Mild	31.72	6.33	2	13.59	<0.01	—
	Moderate	32.62	3.95				
	Severe	37.06	3.35				

4. DISCUSSION

The findings of this study provide a comprehensive understanding of the demographic characteristics, stress levels, and associated factors among family caregivers of patients undergoing hemodialysis. As shown in Table 1, the majority of caregivers were young adults aged 20–30 years (31.7%), followed by those aged 41–50 years (27.5%) and 31–40 years (24.2%). This predominance of younger caregivers aligns with international evidence indicating that adult children and spouses commonly assume caregiving responsibilities, particularly in contexts where institutional support for chronic illness is limited (Ebadi et al., 2021; Al Maqbali et al., 2025). The slightly higher proportion of male caregivers (53.3%) contrasts with studies reporting a predominance of female caregivers (Tudayan-Espiritu, 2024; Shukri et al., 2020), suggesting context-specific socio-cultural dynamics may influence caregiving roles, such as male participation in hospital accompaniment and family decision-making. Most participants were married (65.8%) and identified as spouses of the patients (45.0%), emphasizing the central role of familial relationships in caregiving and supporting Tao et al.'s (2023) dyadic framework, which recognizes the interdependent health outcomes of patients and their caregivers.

Educational attainment and occupational status emerged as key factors influencing caregiver stress. High school education was most common (31.7%), while housewives constituted the largest occupational group (28.3%), followed by private (16.7%) and government employees (12.5%). Prior studies have indicated that lower educational attainment may limit health literacy and coping strategies, thereby exacerbating stress (Padekar et al., 2024; Surani et al., 2021). However, the observed stress among employed caregivers highlights the additional burden imposed by work responsibilities, supporting the assertion that professional demands interact with caregiving duties to heighten psychological strain (Intas et al., 2020). Furthermore, most participants lived in joint family systems (59.2%) and rural areas (42.5%), factors previously identified as moderating stress through enhanced social support and shared caregiving responsibilities (Tao et al., 2023; Sułkowski et al., 2024).

Table 2 demonstrates that an overwhelming 74.2% of caregivers experienced severe stress, with only 0.8% reporting low stress. These findings are consistent with existing literature showing high prevalence of psychological distress—including anxiety, depression, and sleep disturbances—among caregivers of hemodialysis patients (Gerogianni et al., 2021; Shukri et al., 2020; Intas et al., 2020). The severity of stress reflects the complex and enduring nature of caregiving, which often requires managing patients' medical needs, emotional support, and coordination with healthcare systems, potentially leading to significant psychosocial strain (Ebadi et al., 2021).

The associations between stress and caregiver characteristics (Tables 3 and 4) further elucidate the determinants of psychological burden. Younger caregivers, particularly those aged 20–40 years, reported the highest stress levels, possibly due to competing personal, occupational, and familial responsibilities (Al Maqbali et al., 2025). Gender differences were also notable, with males exhibiting slightly higher mean stress scores than females. This finding diverges from prior studies emphasizing higher female stress, suggesting that contextual factors—such as economic responsibilities, primary decision-making roles, or the nature of patient accompaniment—may amplify stress among male caregivers in this setting (Tudayan-Espiritu, 2024).

Occupational status and income were significantly associated with stress levels, with caregivers in the 10,001—15,000 BDT range experiencing the highest stress. This underscores the role of financial strain in exacerbating caregiver burden, in line with prior evidence linking economic hardship to psychological distress (Al Maqbali et al., 2025; Padekar et al., 2024). Additionally, semi-urban residents reported higher stress levels, possibly reflecting the challenges of limited healthcare infrastructure, travel requirements for treatment, and competing work obligations. Family structure also influenced stress: participants from nuclear families experienced higher stress than those from joint families, highlighting the buffering role of extended family support in mitigating caregiver burden (Tao et al., 2023; Surani et al., 2021).

Crucially, patient-related factors, particularly the severity of illness, were strongly associated with caregiver stress. Caregivers attending to patients in severe condition reported the highest stress levels (37.06 ± 3.35), indicating that caregiving demands escalate as patient health deteriorates. This finding corroborates the dyadic illness management theory, which emphasizes the interconnectedness of patient and caregiver well-being (Tao et al., 2023). It also suggests that interventions must consider both patient clinical status and caregiver psychosocial needs to effectively reduce stress and improve overall outcomes.

While these results are broadly consistent with the literature, several critical considerations warrant attention. First, the predominance of severe stress among caregivers may reflect the study's hospital-based sampling, which could overrepresent caregivers of more critically ill patients. Second, the reliance on self-reported measures may introduce response bias, potentially inflating perceived stress levels. Third, socio-cultural and economic contexts may limit the generalizability of findings to other populations or healthcare settings. Despite these limitations, the study provides valuable insights into the factors influencing caregiver stress and highlights the urgent need for targeted interventions.

Practical implications are clear. Structured family-based interventions, including educational programs, counseling, respite services, and financial guidance, have demonstrated effectiveness in reducing caregiver burden and improving quality of life (Surani et al., 2021; Intas et al., 2020). Moreover, early identification of high-risk caregivers based on demographic and patient-related factors—such as age, family type, income, and patient illness severity—can enable proactive psychosocial support. Policy initiatives should integrate caregiver support into routine hemodialysis care, including stress management programs, social support enhancement, and training to improve coping strategies. Such interventions may not only enhance caregiver well-being but also indirectly improve patient adherence and clinical outcomes.

5. CONCLUSION

Caregivers of hemodialysis patients experience substantial psychological burden, with stress levels influenced by demographic, socio-economic, familial, and patient-related factors. Younger caregivers, males, those from nuclear families, and individuals with lower income or caring for patients in severe conditions are particularly vulnerable to elevated stress. These findings highlight the urgent need for support strategies that address both the practical and emotional challenges of caregiving. Interventions such as counseling, educational programs, respite services, and enhanced social support can reduce stress, improve quality of life, and promote more effective caregiving. Integrating caregiver-focused initiatives into routine hemodialysis care is essential not only to safeguard caregiver well-being but also to improve patient outcomes, ensuring a holistic and sustainable approach to chronic kidney disease management.

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