OPEN ACCESS

ISSN: 2837-598X

Imokhai PO, et al. (2025): 144
American J Gyne Obst, 2025(1): 100108
DOI: 10.71010/2837-598X.2025-e108

Research Article

American Journal of Gynecology & Obstetrics

Dermatologic Sequelae in Obstetric Fistula Survivors: Exploring Wound Healing, Chronic Skin Conditions, and Psychosocial Impact

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Citation: Imokhai PO, Hunt J, Kazemeini S, Weitoschova A, Jimoh L, et al. (2025) Dermatologic Sequelae in Obstetric Fistula Survivors: Exploring Wound Healing, Chronic Skin Conditions, and Psychosocial Impact. American J Gyne Obst: AJGO-108.

Received Date: 23 July, 2025; **Accepted Date:** 28 July, 2025; **Published Date:** 04 August, 2025

Abstract

Introduction: *Obstetric fistula (OF) is a debilitating condition caused by prolonged obstructed labor, resulting in urinary and/or fecal incontinence. While surgical repair addresses the underlying injury, long-term dermatologic sequelae, such as chronic dermatitis, pressure ulcers, lichenification, hypertrophic scarring, and pigmentary alterations remain understudied, particularly in individuals with dark skin tones. These complications affect wound healing and carry significant psychosocial consequences, impacting body image, relationships, and mental health. Dermatologic research has historically underrepresented individuals with skin of color, contributing to gaps in knowledge, misdiagnoses, inadequate treatment, and poorer outcomes. Given the increased risk of hypertrophic scarring, keloids, and pigmentary disorders in darker skin tones, further research into these disparities is essential.*

Objectives: *This purpose of this review is to analyze the systemic gaps in dermatologic research regarding individuals with skin of color, with a specific focus on underrepresentation in dermatologic studies, lack of validated scar assessment tools, limited research on post inflammatory hyperpigmentation (PIH) and hypopigmentation, insufficient evidence on treatment efficacy, and educational gaps in dermatologic training.*

Methods: *A comprehensive literature review was conducted to evaluate existing studies on post-surgical wound healing, scar formation, and pigmentary changes in individuals with skin of color. The review assessed clinical trials, scar assessment tools, and dermatologic interventions (e.g., topical corticosteroids, silicone gel sheets) while identifying key gaps in research and clinical practice.*

Results: *The review identified multiple dermatologic complications following obstetric fistula repair in patients with skin of color, including chronic dermatitis, moisture-associated skin damage, hypertrophic scarring, keloids, and pigmentary alterations. Common topical treatments, such as silicone gel sheets, corticosteroids, and zinc oxide lacked robust evidence for effectiveness in melanin-rich skin. Scar assessment tools and clinical trials rarely included Fitzpatrick skin types V–VI, limiting the applicability of their findings. Low-resource settings have not adopted regenerative therapies like platelet-rich plasma or mesenchymal stem cells, despite promising early results. Patients also experienced psychosocial burdens, such as body image distress, depression, marital strain, and discrimination which remain inadequately addressed in current care models.*

Conclusion: *The literature shows a critical lack of research on cutaneous complications following surgery in patients with obstetric fistula and darker skin tones. The physical and psychosocial effects of scarring and pigmentary changes are poorly managed due to research and care disparities. Addressing these gaps requires three key actions: increasing inclusion of skin-of-color participants in clinical trials, developing validated scar assessment tools, and implementing culturally competent dermatologic training. Interdisciplinary approaches that integrate dermatology, surgery, and mental health are urgently needed to improve outcomes and long-term quality of life for this underserved population.*

Keywords: *pelvic scarring, obstetric fistula, Vesicovaginal fistula repair, cutaneous changes, skin color.*

Introduction

An obstetric fistula (OF) is defined as an abnormal connection between the vagina and bladder (vesicovaginal fistula) or rectum (rectovaginal fistula), which primarily develops from extended obstructed labor and surgical procedures and traumatic injuries [1-3]. The condition, obstetric fistulas (OF), exists worldwide but shows its highest rates in low- and middle-income countries (LMICs) because it remains poorly documented in these regions [1, 2]. The medical complications of OF result in severe urinary or fecal incontinence together with serious skin problems and social and psychological issues. Surgical techniques for OF repair have improved, yet many patients face ongoing

dermatologic issues, including dermatitis, pressure ulcers, scarring, and lichenification [4].

The current medical standards primarily focus on surgical fistula repair while giving insufficient attention to dermatologic complications and their treatment approaches. The absence of complete multidisciplinary treatment plans that include obstetrics/gynecology, dermatology, and surgery restricts patient recovery outcomes and their long-term quality of life [5]. The chronic dermatologic conditions cause both physical pain and severe damage to patients' self-image and intimacy and mental health, which worsens social reintegration challenges and stigma and marital problems and economic strain [4]. The current clinical practice faces a major drawback because there is insufficient research about skin complications that occur after OF repair, especially among patients with dark skin tones (Fitzpatrick type V-VI). People with dark skin tones (Fitzpatrick type V-VI) experience different wound-healing responses because their skin shows higher vulnerability to hypertrophic scars, keloids, and pigmentary disorders. The insufficient knowledge about these dermatologic outcomes leads to incorrect diagnoses and delayed medical interventions and insufficient treatment plans [4].

Obstetric fistulas severely affect how Black women view themselves and their ability to be intimate while also damaging their mental health. Research shows that women who have obstetric fistulas in low-income African nations experience severe psychological and social difficulties. The research by Debele et al. (2024) revealed that women who received surgical treatment for their fistulas continued to encounter social problems, which led to financial difficulties and marriage and family problems that reduced their social involvement [5]. The findings demonstrate the persistent mental health consequences and the requirement for complete support services after surgical treatment. Duko et al. (2021) performed a systematic review and meta-analysis which demonstrated that depression affects 74.4% of Ethiopian women who have obstetric fistulas in low-income African countries [6]. The research demonstrates that obstetric fistulas create substantial mental health problems which require mental health treatment programs. The combined research shows that obstetric fistulas create extensive effects on self-image and intimacy and mental health which requires a comprehensive care system that includes psychological support and social reintegration programs [7].

The identification of these essential knowledge gaps presents significant clinical and societal value. Knowledge about the dermatologic complications after OF surgical repair, especially for women with dark skin, would help develop specific therapeutic approaches to enhance long-term results. The review combines existing evidence about OF surgical dermatologic complications while revealing unequal skin care for patients with dark skin and emphasizing the necessity of combined research and clinical partnerships to improve treatment standards and patient quality of life.

Pathophysiology of Wound Healing in Obstetric Fistula Repair

In the acute timeline, the first stage of normal wound healing is the inflammatory phase, which is characterized by hemostasis, as well as the release of cytokines, growth factors, and leukocytes [8]. The robust recruitment of immune cells reduces the risk of infection after skin damage. Subsequently, the proliferative stage involves the recruitment and proliferation of growth factors, keratinocytes, fibroblasts, and endothelial cells in the wound [8]. In this phase, the extracellular matrix predominates, ensuring structural support for key angiogenic factors that vascularize newly synthesized granulation tissue. The final phase of wound healing is the remodeling phase, where the extracellular matrix is remodeled from collagen III to collagen I to provide optimal tensile strength and integrity [8]. The end of phase three typically results in scar formation, which indicates that skin barrier integrity has been restored.

In comparison to acute wounds, the presence of prolonged stages in chronic wounds underscores potential pathologic wound healing. Chronic wounds are characterized by continuous inflammation, persistent infections, and necrosis [8]. The inability to restore the skin's barrier is low-hanging fruit for pathogens to enter and create a cascade of increased immunologic activation. Bacterial biofilms on the surface activate the host's neutrophils and pro-inflammatory macrophages, resulting in the accumulation of inflammatory cytokines such as TNF-α and IL-6 [8]. Penetrating the resilient barrier of bacterial biofilm is a challenge to managing chronic wounds and may require extensive infectious disease and pharmacologic consultation for optimized treatment. In addition, these elevated cytokines can contribute to chronic irritation from mast cell recruitment [8]. Repeated excoriation creates increased patient discomfort and propensity of tissue lichenification, which over time can worsen cosmetic and psychosocial outcomes.

Osseous Healing

Osseous healing is crucial for ensuring pelvic stability, which is necessary for quality-of-life measures such as weight bearing against gravity, walking, strength, and full range of motion of the affected bone site. There are four stages of osseous healing: 1) cell activation, 2) resorption, 3) reversal, 4) bone formation. The first stage is characterized by inflammation, followed by the second stage which involves cartilage formation with angiogenesis [9]. Similar to cutaneous healing, the second stage lays the foundation and vascular supply necessary to support novel growth. The third stage involves cartilage removal and calcification of callus, culminating in the fourth and final stage of bone remodeling [9]. In bone formation, type I collagen predominates. due to its ability to retain structure and strength necessary to support weight-bearing against gravity.

Protraction of osseous healing phases warrants further investigation for potentially treatable etiologies. Poor osseous healing is known to be adversely impacted by pre-existing comorbidities and individual lifestyle factors. Risk factors for nonunion include age, smoking, displacement, diabetes, obesity, alcohol, NSAIDs, PPIs, and steroids [9]. Smoking, for example, reduces local circulation via vasoconstriction, which can delay access to the vascularity needed for new tissue to thrive, whereas chronic alcohol use can cause malnutrition that depletes factors involved in collagen synthesis. At the molecular level, osseous healing is also disrupted by immune cell deficiencies. Compared to healthy persons, those with low transforming growth factor (TGF)-β, fibroblast growth factor (FGF), and osteoblast cell number and functionality were more at risk for bone non-union [9]. These findings suggest specific molecular mechanisms that dysregulate wound healing, which may indicate therapeutic utility in monitoring clinical patterns and fluctuations over time.

Unique Challenges in Obstetrics Fistula Patients

Unique considerations are required in post-operative management of obstetric fistulas, given that the anatomy in this region has both external cutaneous and internal mucosal surfaces. Moisture associated skin damage (MASD) in the perineal area occurs with several sources including urine, fecal matter, perspiration, or leakage from wound breakdown [10]. For obstetric fistula, the most prevalently researched concerns for irritant contact dermatitis are urinary and fecal incontinence, given the close proximity of the bladder and rectum to the vaginal opening. Clinical signs of incontinence-associated, irritant dermatitis may include erythema or partial-thickness skin loss,while commonly encountered symptoms involve itching, burning and pain [10]. In addition, urine pH is an important factor in evaluating skin barrier damage from urinary incontinence, as the skin of the upper thigh is normally not tolerant to this pH. Pseudoverrucous lesions, a thickening of the peristomal epidermis that appears as warty, white, and gray lesions, may occur with chronic exposure to alkaline urine [10]. These symptoms occurring in are perceived as a sensitive area, can be psychologically distressing. It's important to educate patients prior to discharge regarding periwound skin health, warning signs and symptoms, and when and where to seek care [10].

Fibrosis and scarring

Scar formation is expected in normal wound healing as it signals adequate reapproximation of skin. However, there are several factors that may predispose an individual to pathologic scarring, where the immune cells overachieve the goal of repairing the damaged skin barrier. In pre-operative planning for obstetric fistula repair, obtaining a comprehensive medical history can provide salient clues to ascertain fibrosis risk, including previous abdominal or genitourinary surgeries. Pre-existing adhesions and fibrosis restrict the mobility of tissue and require excessive tension that can progress to wound dehiscence perioperatively [11]. Even for patients without previous obstetric surgical history, fibrosis remains a concern for overall functionality and increased risk for re-operation. Previous study revealed the presence of moderate to severe scar fibrosis was associated with a repair failure rate of 17%, compared with only 3% in participants with no scar fibrosis or mild fibrosis [11]. This risk of repair failure is incrementally increased with larger sized fistulas (> 3 cm).

As an additional consideration, fibrosis can impair local vascularization, compromising suture consolidation [11]. Compromised neurovascular supply can lead to prolonged wound healing phases and increased discomfort for patients, particularly related to sexual intimacy. Restrictive vulvar tissue from adhesions can cause dyspareunia that impacts overall patient satisfaction. Previous studies demonstrated resolved symptom burden after complete excision of fibrous scar tissue and anatomical tissue layer reconstruction after secondary repair [12]. The associated discomfort resulting from fibrotic tissue after obstetric repair necessitates further research into improved diagnosis and identifying therapeutic interventions.

Dermatologic Complications Post-Fistula Repair

The vagina-vulva region shares both internal and external cutaneous properties, increasing the likelihood of dermatological complications post-fistula repair. Most of the literature examining the impact of incontinence have been studied in postmenopausal women, as this complication is generally considered uncommon in younger patient populations. However, reproductive aged patients can experience chronic dermatitis as a possible dermatologic sequelae after obstetric fistula repair. Previous studies have found a significant correlation between fecal and double (urinary and fecal) incontinence with subsequent development of chronic dermatitis [13]. Severe pruritus is the most commonly reported clinical manifestation.

At first glance, pruritic symptoms can be attributed to contact dermatitis, however, chronic dermatitis presents similarly with key differentiators underneath the surface that histopathology can address. Chronic dermatitis penetrates beneath the surface level. Previous studies have suggested an association amongst digestive enzymes in fecal matter and surface-level proteolytic skin maceration [13]. After initial epidermal integrity is lost, this creates a pathway for intestinal bacteria to enter deeper layers uninhibited. Intestinal bacteria inoculation is speculated to contribute to inner skin-tissue degradation and immunologic response recruitment [13]. Targeted research for these mechanisms are understudied but critical in identifying interventions to address the pro-inflammatory and proteolytic etiologies of dermatitis in this region.

It is reasonable to presume that similar mechanisms of barrier dysfunction contribute to the development of perineal dermatitis post-obstetric fistula repair. Skin maceration, which is caused by exposure to excessive fluid, is recognized as one of the risk factors for skin lesion development [13]. This localized skin breakdown of the stratum corneum further exposes deeper layers of epidermis. Maceration disrupts intercellular lipids layers and keratinocyte junctions, decreasing the structural integrity of the epidermis [13]. With part of the main component of cellular membranes damaged, there is an increased propensity of transepidermal water loss into the interstitial space. This skin barrier breakdown as a result of fluid irritants can trigger the immunologic response that forms skin lesions, such as perineal dermatitis [13]. Thus, the outcomes of maceration-associated structural loss should include consideration of potential infection as well as dermatologic lesions that may cause persistent pruritus and discomfort to the patient.

Contact irritant dermatitis from urine, feces, and hygiene products

Histopathology defines irritant contact dermatitis as confined to superficial skin, such as the epidermis or dermal-epidermal junction [13]. Vesicovaginal fistulas, a common postoperative complication of obstetric fistula repair, can involve both physical and psychological discomfort for patients. The vulvar-vaginal region is composed of sensitive tissue that thrives in a very specific pH range. Vulvar tissue can develop irritant dermatitis from urine or fecal matter itself, as well as from unintended sources, such as self-selected hygiene products used to reduce odor and itching. In addition, the acidity of urine pH and subsequent skin breakdown from excoriations can result in urinary ammonia deposition [14]. These local disturbances in pH can create a cascade effect with skin breakdown that increases the risk of infection. Dermatologic complications after obstetric fistula repair remains relatively understudied with few articles since 2015. Further studies can explore this important topic to reduce the symptomatic burden and complications that impede long-term recovery.

Allergic dermatitis to topical wound dressings or sutures

Allergic dermatitis refers to a dermatologic manifestation of a robust immune response to an environmental exposure. The overall incidence of allergic dermatitis is rare, but when it occurs, can compromise the efficacy of wound closure [15]. Common examples of wound closing agents include sutures, staples, and adhesives. The goals of wound closure are to encourage proper healing and prevent infection through adequate tissue approximation. Comprehensive pre-operative history taking is critical for ascertaining known allergic reactions which may impact the wound closure agents used, however, it is possible for patients to have a new unknown allergy after a novel exposure. Emerging technologies such as surgical glues and antibiotic-coated sutures can introduce new allergens [15].

Despite the rare incidence of allergic dermatitis, astute observation of obstetric fistula repair patients in the immediate postoperative period can lead to prompt identification, diagnosis, and intervention. Daily assessment of wounds is an important factor that can expedite symptom relief, promote antibiotic stewardship through preventing unnecessary utilization, and imaging procedures [15]. This is an essential measure of providing quality care that minimizes unnecessary cost burdens for patients. There are several signs and symptoms that can guide clinical suspicion of allergic dermatitis. Diagnosis relies on clinical examination of localized erythematous wheals and weeping, patient-reported pruritus, and temporal association of symptom onset and potential exposures [15]. The presence of fever, fluctuant mass, or purulence may be more suggestive of an infection. Excoriation for patient symptom relief puts the site at risk for wound dehiscence, so prompt discovery and treatment of allergic dermatitis with removal of the offending agent is pertinent.

Hypertrophic Scarring & Keloids

Successful post-operative wound healing is contingent upon scar formation. For some individuals who mount a robust collagen production response, such scarring becomes pathologic. Both keloid and hypertrophic scarring formation result from disorganized collagen. In contrast to normal wound healing, which involves the replacement of type III collagen with type I collagen, hypertrophic scars are defined by type III collagen predominance [16]. Type III collagen provides less tensile strength and less structural integrity in skin repair. Keloid scars have increased wavy, disorganized types I and III collagen which extend past the borders of the original wound [16]. In both hypertrophic scarring and keloid formation, excess collagen is produced, however, hypertrophic scarring is confined to the borders of the original wound. Additionally, hypertrophic scarring tends to occur within two months of wound closure and can regress spontaneously, whereas keloid scarring often appears years after skin insult and is more permanent [16].

The propensity to overproduce collagen is influenced by genetic and epigenetic factors, including exposure to oxidative stress. Excessive inflammation or poor local oxygenation can distort wound repair and produce excessive amounts of free radicals and reactive oxidative species [16]. Examining wound healing success at the histopathological level can aid in identifying and isolating mediators of abnormal scar formation. The formation of hypertrophic scars and keloids has been predominantly associated with darker skin tones. African and Asian patients are presumed to have a predilection for keloid scarring through inheritance patterns. A previous genome-wide association study suggests a correlation between keloids and the 2q23 chromosomal region in Japanese families, and the 7p11 chromosome in African American families [16]. Continued research to illicit the association between darker skin tones and subsequent development of keloids is of important concern to guide prevention and intervention efforts, as keloids are known to recur. Additionally, disorganized scar formation can occur because of disrupted processes within collagen synthesis. TGFβ and platelet-derived growth factor (PDGF) are involved in angiogenesis, fibroblast chemotaxis, and wound contractions which contribute to excess collagen production [16]. Lastly, patient lifestyle factors impact wound healing and scar formation. Patients with vitamin C deficiency from alcohol use or diet eliminates an essential cofactor in collagen synthesis involved in the hydroxylation of proline and lysine [16]. In general, Vitamin C deficient patients are predisposed to develop scurvy, which presents as easy bruising or bleeding. Cigarette smoking causes vasoconstriction thereby reducing tissue perfusion and producing reactive oxygen species that modify the skin's extracellular matrix resulting in uneven synthesis and degradation of collagen [16]. It is important to keep all the individual factors of a patient's history in mind to properly assess their risk for keloid formation.

Post-Surgical Nonunion or Delayed Healing in Pelvic Fractures

Obstetrical procedures, including planned vaginal deliveries and emergent C-sections, can be traumatic to a mother's body, placing the patient at risk of musculoskeletal sequelae and pelvic fracture. Peroneal nerve injury, resulting in leg weakness and foot drop, significantly lower ankle joint range of motion and strength, lower range of knee joint motion have commonly been found associated with obstetric fistula at a higher percentage in primiparous versus multiparous fistula patients [17]. This can result in walking difficulties that impact quality of life in patients. Movement is critical in the postoperative period and is essential for the prevention of deep vein thrombosis, so this is something to target for prevention of this and also improved wound healing.

The pelvis is a stabilizing structure of the lower extremity and trunk with major structures passing through, including genitourinary, vascular, neurologic, and gastrointestinal structures [18]. In normal, spontaneous vaginal delivery, cephalopelvic disproportion refers to the resistance of the fetal head from passing through the pelvis, which if prolonged enough can likely predispose a patient to fracture. The incidence of pelvic fractures in obstetrics has not been characterized in recent literature. However, pelvic fractures require immediate recognition and management to avoid further complications of trauma-associated birth. Delayed diagnosis of pelvic fractures can result in vaginal injury that leads to long-term complications such as vaginal stenosis, atresia, and urethra or rectal associated fistula [19]. In addition, unstable pelvic rings displaced during pelvic fracture can compromise surrounding blood supply, which impacts wound healing in obstetric fistula tissue. Surgical indications are based on degree of fracture displacement, associated injuries, patient age, and patient functional status [19]. For younger patients, there is intentional consideration of the potential desire for future planned or unplanned pregnancies. Clinical decision making should be guided by discussions with patients to ascertain important aspects in their quality of life.

Rates of sexual dysfunction after pelvic fracture could be as high as 40% [19].

Surgical nonunion poses a significant challenge in wound healing. The US Federal Drug Administration defines fracture nonunion as the persistence of a radiologically visible fracture line at greater than 9 months post-injury [20]. Predisposes patients to avascular necrosis which can impact walking stability. Although the specific incidence of nonunion in obstetric cases is understudied, the overall incidence of nonunion in surgically managed fracture cases is about 10-15%, which has been relatively consistent for the past 40 years [20]. One of the most common surgical interventions for pelvic fracture is open reduction and internal fixation (ORIF.) The goal of ORIF is to distribute force evenly--allowing for necessary load bearing functions, preservation of the bone's original anatomy [20]. In maintaining the bone's structure, ORIF seeks to reduce the risk of compression to nearby neurovascular tissues, ensuring that new cartilage remodeling can occur with an adequate blood supply. Successful bone healing is influenced by the mechanical stress on the bone, as well as patient-dependent factors, medications, such as comorbidities or lifestyle choices like smoking history [20]. Targeting nonunion is important for a patient's quality of life with return to baseline functionality and work, as well as medical costs associated with care.

Current Treatment Approaches

Topical Therapies

Topical agents are important in managing dermatologic complications in women after obstetric fistula repair, such as moisture-associated skin damage (MASD) and chronic dermatitis. Zinc oxide-based barriers and petroleum jelly are first-line interventions to reduce skin maceration and restore epidermal barrier function [21]. These agents create a physical shield and minimize trans-epidermal water loss, which helps address inflammation and delayed wound healing in the groin regions. Furthermore, emollients rich in ceramides can repair the lipid matrix of the stratum corneum [22]. This is especially helpful in patients with persistent exposure to irritants. For women experiencing localized inflammatory lesions, topical corticosteroids can be useful in reducing cytokine activity. Their use should be time-limited, as prolonged application in thin-skinned areas increases the risk of skin atrophy and secondary infections [23]. Despite their common use in clinical practice, there are few studies that have examined optimal corticosteroid potency in melanin-rich skin following fistula repair.

Silicone gel sheets offer another effective topical strategy in patients at risk of hypertrophic scarring or keloid formation. These sheets help regulate fibroblast activity and reduce collagen accumulation during the remodeling phase of wound healing [24]. Their use may be especially important for women with darker skin tones, who are more prone to abnormal scarring. For patients with postinflammatory hyperpigmentation, agents such as hydroquinone, azelaic acid, and topical retinoids may be used to reduce pigmentation irregularities [25]. These compounds work by interfering with melanin synthesis or accelerating epidermal turnover. In addition to these approaches, there is growing interest in biologically active topical therapies, such as platelet-rich plasma (PRP) and extracellular vesicles (EVs). Although PRP is typically administered through injections, topical formulations have been investigated for their ability to deliver concentrated growth factors to epithelial surfaces [26]. This approach may be especially helpful in settings where access to procedural care is limited. EVs, including exosomes derived from mesenchymal stem cells, carry bioactive molecules that support tissue regeneration through immune modulation and paracrine signaling [27]. While not yet part of standard post-fistula care, these therapies represent an exciting area of exploration in dermatologic wound healing.

Systemic & Regenerative Approaches

While topical therapies are often used to address skin complications after obstetric fistula repair, systemic and regenerative approaches may be necessary in treatment-resistant cases. Systemic antibiotics are commonly used to treat chronic wounds with signs of secondary infection [28]. However, their overuse may lead to antimicrobial resistance and disruption of the skin and gut microbiota. This has led to increased interest in more targeted antimicrobial strategies, such as wound culture or microbial profiling, to better guide treatment [29]. Stem cell–based regenerative therapies are another option for promoting wound healing and minimizing fibrosis. Mesenchymal stem cells have been shown to enhance angiogenesis, modulate local inflammation, and support re-epithelialization in chronic wounds [30]. These therapies may be beneficial for patients with high-risk skin types or delayed healing. Despite their potential, regenerative treatments are rarely included in standard fistula aftercare. Because patients frequently experience scarring, pigmentary changes, and persistent irritation, there is a growing need for dermatology-informed interventions in obstetric fistula repair follow-up.

Surgical Revisions for Severe Dermatologic Sequelae

For patients with severe post-fistula dermatologic sequelae, surgical revision may be necessary to improve function and appearance. Excessive fibrotic tissue can decrease range of motion and cause pain during movement, especially in groin regions [31]. In such cases, excision of fibrotic tissue can help restore mobility and alleviate symptoms by reducing mechanical restriction. In recent years, fractional CO_2 laser therapy has become an increasingly favored option for treating hyperpigmented scars [32]. It has been identified to improve texture and tone with relatively low complication rates by creating controlled micro-injuries that increase dermal remodeling. For wounds that remain non-healing, skin grafting may be considered. Autologous fat grafting has shown additional benefit in improving scar pliability and restoring pigment uniformity [33]. This may be due to the regenerative properties of adipose-derived stem cells. Despite the growing number of procedural options, many of these techniques are not commonly used in low-resource settings due to limited access and cost.

The Psychosocial Impact of Chronic Skin Complications

People with highly pigmented skin often face discrimination and lower self-esteem due to their skin color alone, which can negatively impact their physical and mental health [34]. Additionally, darker skin tones are more prone to pronounced scarring and pigmentation changes, further heightening aesthetic concerns and exacerbating self-esteem issues.

Chronic skin diseases such as acne, eczema, and psoriasis can contribute to psychological distress, including stress, anxiety, depression, and low self-esteem [35]. Visible skin conditions, particularly scars, can significantly impact an individual's quality of life and self-esteem, with more recent and prominent

scars having a greater negative effect [36]. For people of color, the psychosocial burden is often heightened due to the visibility of their conditions and the stigma associated with them [37].

Chronic skin conditions can significantly impact intimate relationships and sexual health, as the associated psychological burden—such as anxiety, depression, and social phobia—can further strain relationships [35]. Conditions like vitiligo have been shown to negatively affect marriage potential and cause relationship difficulties for a significant portion of patients [38]. These conditions can also contribute to a disturbed body image and reduced self-esteem, leading to feelings of shame, social isolation, and frustration, which may exacerbate the condition and create a vicious cycle [39]. Additionally, cultural perceptions of beauty play a significant role in shaping the cosmetic concerns of people with skin of color, further influencing their self-image and emotional well-being.

Chronic skin conditions are frequently linked to mental health issues such as anxiety and depression, a connection that is particularly significant among people of color, who often face additional psychosocial burdens due to their skin conditions. Common mental health disorders, including anxiety and depression, have a lifetime prevalence of up to 20% and are frequently comorbid with chronic skin disease [40]. Certain conditions, such as lichen planus and rosacea, have especially strong associations with anxiety and depression, with prevalence rates of around 27-28% for both conditions [41,42]. People of color with chronic skin conditions often encounter unique challenges. A survey found that 57.4% of people of color reported their skin conditions had a negative impact on their mental health, with common concerns including discoloration, acne-related pigmentation changes, and ingrown hairs [36].
Many patients with visible chronic skin diseases face discrimination and stigmatization, which can lead to significant psychosocial impairments such as social anxiety, depression, and anxiety disorders [43]. The negative impact on mental health and quality of life highlights the need for targeted interventions to address the psychological burden in this patient population [44]. Because skin plays a crucial role in interpersonal interactions, visible skin disorders can strongly influence others' behaviors and attitudes, further contributing to stigmatization and discrimination [45].

Social & Cultural Factors

Visible scarring and pigmentary disorders can greatly affect the social and psychological well-being of people of color, often resulting in social exclusion and discrimination. A key issue within and between racial groups is colorism, discrimination based on skin tone, which has been linked to various psychiatric conditions, including anxiety and substance use disorders, particularly among Black Americans [46]. This form of discrimination contributes to social stratification and health disparities. Scarring can further lead to social isolation, as individuals may become self-conscious and withdraw from social interactions. Societal preference for unblemished skin often intensifies this marginalization of those with visible skin conditions [47].

Women with obstetric fistula often endure significant social stigma and abandonment by both their partners and communities, resulting in high rates of divorce and social isolation, both before and after repair [48]. A study of 899 women with obstetric fistula in central Nigeria revealed that nearly 50 percent had been divorced due to fistula-related issues [49]. This underscores the profound strain this condition places on relationships and marriages, alongside the social stigma and discrimination that women face.

Women who undergo fistula repair often face intense stigma and social isolation due to their condition. This stigma extends to various aspects of their health, including skin conditions, which may be seen as signs of impurity or illness. Reintegration into their communities can be difficult, as women may feel compelled to "prove" their worthiness of acceptance, often by concealing any lingering health issues, including skin conditions [50]. Myths and misconceptions about health conditions, such as beliefs tied to witchcraft, can further influence how skin conditions are perceived and managed [51].

Mental Health Outcomes

Chronic skin conditions have a profound impact on the mental health of patients, including those of color, contributing to psychological issues such as depression, PTSD, and psychosexual dysfunction. Depression is particularly prevalent among individuals with chronic skin conditions, with some studies reporting rates as high as 39.25% [52]. These conditions also significantly affect patients' sexual health, leading to psychosexual dysfunction, including low self-esteem and embarrassment, which can strain intimate relationships (Jafferany & Pastolero, 2018). Moreover, a study by Strange et al. [53] found that 47.1% of participants experienced clinical levels of PTSD symptoms, which were linked to a poorer skin-related quality of life [51]. Patients with chronic skin conditions, especially people of color, are particularly vulnerable to mental health challenges such as depression, PTSD, and psychosexual dysfunction.

Barriers to Specialized Care

People of color face numerous barriers to accessing dermatologic care for chronic skin conditions. Financial constraints are a major challenge, with many patients delaying treatment due to the high cost of care [54]. Additionally, inadequate health insurance is a widespread issue, particularly among Black and Hispanic populations [55]. Living in medically underserved or rural areas further limits access to dermatologic services [56]. Personal beliefs about health and treatment also play a role in whether individuals seek care [57]. Addressing these barriers requires a comprehensive approach, including improving insurance coverage, increasing the availability of dermatologists in underserved areas, enhancing cultural competence among healthcare providers, and utilizing technology to offer remote care.

The lack of dermatological care tailored to darker skin tones is a significant issue, as many people of color feel that available treatments do not meet their specific needs, and often perceive dermatologists as insufficiently trained to treat their skin [36]. The underrepresentation of skin of color dermatology in medical education contributes to negative experiences, missed or delayed diagnoses, and broader health inequities for individuals of color [58]. This scarcity of skin tone diversity in dermatology can deter patients from seeking care, resulting in untreated or poorly managed skin conditions and related mental health challenges [34]. Ultimately, patients with skin of color face significant barriers, such as delayed diagnoses and subpar care, due to limited access to dermatologists, especially in areas with a lower density of dermatologists, which often overlap with

communities that have a higher proportion of people of color [59].

The barriers to accessing affordable treatments for chronic pigmentary disorders and scarring are complex and can be categorized into several key areas: economic, geographical, knowledge and awareness, and treatment-related. One major obstacle is the high cost of treatments, especially biologics and advanced therapies, which remains a significant issue in the management of chronic dermatological diseases, where expensive therapies and low reimbursement rates are common [60]. Patients in rural areas face additional difficulties, such as the distance to healthcare facilities and the high travel costs, which can delay both diagnosis and treatment. Furthermore, both patients and healthcare providers may lack sufficient knowledge about available treatments and their proper use, leading to under-treatment or inappropriate care [61]. Pigmentary disorders like melasma and post-inflammatory hyperpigmentation are particularly challenging, as they are resistant to treatment and prone to recurrence, complicating management and driving up long-term costs [62]. Addressing these barriers requires a comprehensive approach, including policy changes, enhanced education for both patients and providers, and continued research to develop more accessible and effective treatments.

Future Directions and Research Gaps

The management of obstetric fistulas and post-repair cutaneous changes requires a collaborative approach that involves OB/GYNs, surgeons, dermatologists, and physiotherapists. This interdisciplinary teamwork ensures comprehensive care, addressing both surgical and post-surgical needs, ultimately improving health outcomes and quality of life. Effective collaboration is often supported by team training and communication strategies. Simulation-based teamwork training has been shown to enhance team performance and reduce patient morbidity in obstetrics, a benefit that can be applied to managing complex cases like obstetric fistulas [63].

When comparing topical and systemic treatments, key factors include application, effectiveness, side effects, and resistance. Topical treatments target the wound site, providing immediate local effects with fewer systemic side effects and lower resistance risks, while systemic treatments address broader issues but come with more extensive side effects and higher resistance potential, particularly with antibiotics. Regenerative treatments, on the other hand, focus on restoring native tissue structure and function, promoting more effective and faster healing [64]. These approaches can be customized to the patient's needs, potentially reducing the burden of chronic wounds [65]. While both topical and systemic treatments play important roles in wound management, regenerative medicine offers promising new possibilities for accelerating healing through advanced therapies like stem cells, growth factors, and biomaterials.

Mental health screening is crucial for post-fistula repair patients, as depression and other mental health issues are highly prevalent. For instance, in Mali, 36.5% of women had moderate or severe depression at intake, which decreased to 16.9% three months after surgery [66]. Routine mental health assessments, such as the PHQ-9, can track depression and identify patients needing additional support. Rehabilitation programs must also account for the cultural, social, and economic contexts of patients. In northern Ghana, reintegration challenges arose from cultural perceptions and economic barriers [50], while in Ethiopia, community outreach and income-generating initiatives helped women reintegrate [67]. By tailoring programs to these specific needs, we can reduce stigma and improve both mental health and reintegration outcomes for patients.

Increasing the inclusion of skin of color in clinical research is crucial for ensuring that study results are generalizable and applicable to a broader population, encompassing diverse races, ethnicities, genders, and socioeconomic backgrounds. In addition to enhancing recruitment and study design, attention must also be given to the tools used for scar assessment. Many of these tools lack validation in diverse populations. A systematic review found that only 4 out of 15 studies included dark-skinned individuals, who are more prone to keloid formation and altered pigmentation [68]. This lack of inclusivity can result in inaccurate assessments and a diminished quality of life for these patients. To improve clinical decision-making and outcomes, it is essential to involve patients of color in the development and validation of scar assessment tools.

Developing treatment guidelines for hypertrophic scarring, keloids, and pigmentary disorders requires a multifaceted approach that considers both biological mechanisms and cultural factors. Individuals with Fitzpatrick skin types IV–VI are more prone to hypertrophic and keloid scarring, yet current literature lacks comprehensive treatment protocols for these populations [69]. To address this gap, specific guidelines tailored to skin of color are needed. Effective management of hypertrophic scars and keloids also requires collaboration from a multidisciplinary team, including dermatologists, plastic surgeons, and psychosocial experts.

The need for specialized training in dermatology for skin of color is increasingly recognized, given the unique challenges and conditions affecting these populations. Dermatology residency programs should include modules on skin of color, covering clinical presentations, treatment options, and cultural considerations, to better equip future dermatologists and surgeons in managing diverse patient populations. Interdisciplinary collaboration is also crucial for providing comprehensive care, particularly for conditions that span multiple specialties. Establishing integrated care models that involve dermatologists, OB/GYNs, and surgeons can significantly improve patient outcomes.

Future advancements in wound healing aim to integrate molecular and regenerative approaches, including TGF inhibitors and ECM modulators. TGF-β, a key regulator in fibrosis, drives fibroblast proliferation and ECM production, contributing to excessive scarring. Inhibiting TGF-β signaling with modulators like Ski and Nrf2 activators could reduce fibrosis and improve healing in fistula repair [70]. The extracellular matrix (ECM) plays a vital role in wound healing by regulating cellular functions, mediating interactions, and modulating cytokine and growth factor activity. Understanding its composition in normal and scarred skin highlights its influence on wound healing and scar formation [71]. Genetic profiling offers a promising avenue for personalized wound healing strategies by identifying genetic factors that impact healing and tailoring treatments accordingly. Since genetic predispositions influence chronic wound development and healing efficiency, personalized treatment plans can enhance outcomes. Multiomics, integrating genomics, transcriptomics,

proteomics, and metabolomics, provides a comprehensive understanding of molecular mechanisms in wound healing, enabling the discovery of novel biomarkers and therapeutic targets [72]. Gene therapy, including gene-activated matrices, is being explored to regulate genes involved in inflammation, angiogenesis, and re-epithelialization, further enhancing treatment options. While these approaches have the potential to revolutionize wound care, continued research and clinical validation are necessary to translate these innovations into practice.

Conclusion

Obstetric fistula repair presents multiple challenges that include dermatological and psychological aspects especially when treating patients with dark skin tones. Medical professionals primarily concentrate on anatomical correction yet they commonly overlook the long-term skin complications that include chronic dermatitis together with fibrosis and hypertrophic scarring and keloids and pigmentary changes. The complications that arise from these conditions negatively impact both the physical comfort and emotional wellbeing and quality of life of affected individuals. The populations with darker skin types remain underrepresented in dermatologic research and clinical trials despite known differences in wound healing and scarring patterns.

A comprehensive interdisciplinary care model needs to become the standard approach. A better approach to post-repair challenges requires joint participation between OB/GYNs and surgeons and dermatologists and mental health professionals. The inclusion of dermatological expertise during fistula aftercare particularly for patients with skin of color will lead to improved results in both appearance and functionality. The social stigma and emotional distress and relational disruptions that patients experience require both mental health support and community reintegration services to be prioritized.

The path toward progress requires recognition of existing knowledge gaps and care delivery deficiencies. The development of post-operative care protocols requires specific dermatologic and psychosocial considerations for patients who have skin of color. The inclusion of diversity in future research and clinical education and treatment frameworks will create pathways toward fair and successful outcomes for every fistula patient.

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