Keloids

By Albert E. Zhou, MD, PhD, Kelley Sharp, MD, and Hao Feng, MD, MHS, FAAD

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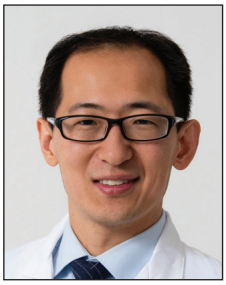

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I. DEFINITION & PATHOGENESIS

Feature	Description
Definition	Benign fibrous overgrowths extending beyond original wound margins
Etiology	Dysregulated wound healing → excess type III > type I collagen deposition
Genetics	Associated with HLA-B14, -B21, -BW16, -DR5; more prevalent in Fitzpatrick IV-VI
Cellular players	↑ Fibroblast proliferation, ↓ apoptosis, ↑ TGF-β1, VEGF, PDGF
Triggers	Skin trauma (surgical wounds, piercings, burns, acne), infections, PFB, AKN

Wound healing ➜ prolonged inflammation ➜ ↑ TGF-β1 ➜ excess fibroblast activity ➜ disorganized collagen deposition ➜ keloid

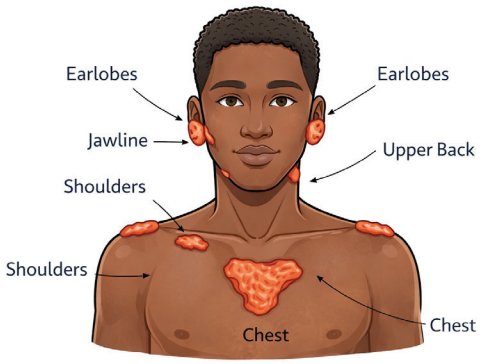
II. DIFFERENTIAL DIAGNOSIS

Condition	Distinguishing features
Hypertrophic scar	Confined to wound; may regress
Dermatofibroma	Firm, dimple sign positive, non-tender
DFSP	Slow-growing plaque; CD34+ on biopsy
Sarcoidosis	Non-caseating granulomas; systemic signs
Colloid milium	Waxy papules; sun-exposed areas
Scarring alopecia	Evaluate LPP, CCCA, AKN if scalp involvement
Pseudofolliculitis barbae (PFB)	Follicular-based papules/pustules in beard area; risk factor for keloid formation
Acne keloidalis nuchae (AKN)	Chronic inflammatory papules on nape of neck → keloid-like plaques; often coexists with true keloids

III. CLINICAL FEATURES

- Pruritic, firm, shiny pink/purple papules or plaques
- Location: Earlobes, shoulders, chest, jawline, upper back
- AKN may mimic or coexist with keloids on posterior neck
- May be painful or tender
- No spontaneous resolution

Most Commonly Affected Sites for Keloids



IV. HISTOLOGY

Feature	Keloid	Hypertrophic scar
Collagen arrangement	Broad, thick, disorganized bundles ("keloidal collagen")	Parallel, wavy bundles (Type III → Type I)
Collagen type	↑ Type III > I; disorganized	Initially ↑ Type III → matures to Type I
Borders	Extends beyond original wound margins	Confined within original wound margins
Vascularity	Decreased in mature keloid	Increased in early hypertrophic scars; more prevalent and vertically arranged
Inflammatory infiltrate	Sparse, chronic	Moderate, active inflammation in early stages
Appendages	Frequently absent	May be preserved or partially damaged
Fibroblasts	Large, plump, active	Spindle-shaped, less active over time
Re-epithelialization	Often normal	Typically normal

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V. MANAGEMENT & TREATMENT OPTIONS

Modality	Mechanism	Notes
ILK (triamcinolone)	↓ Fibroblast activity	10–40 mg/mL every 4–6 weeks
5-FU (fluorouracil)	Antimetabolite	Often combined with ILK
Silicone sheeting/gel	Occlusion, hydration	Best for prevention/post-excision
Cryotherapy	Vascular injury → necrosis	Small lesions; caution in dark skin
Laser (PDL, CO_2)	↓ Vascularity, remodels collagen	Use with ILK/5-FU
Radiation therapy	Fibroblast apoptosis	Infrequently used; post-op only
Excision	Physical removal	Recurrence rate high if monotherapy
Topical clindamycin/ benzoyl peroxide	For PFB/AKN prevention	Use alongside hair removal strategies
*** Combination therapies = most effective approach ***		

Emerging and experimental treatment options		
Agent	**Mechanism/target**	**Clinical notes**
Botulinum toxin A (BoNT-A)	↓ Tension & fibroblast TGF-β1 signaling	Improves scar pliability, ↓ recurrence when combined with ILK
Verapamil	Calcium channel blocker; ↓ collagen synthesis	Intralesional use; mixed results
Imiquimod 5% cream	Immunomodulation via TLR-7	Post-excision topical use; limited efficacy
Bleomycin	Antitumor antibiotic	Intralesional; ↓ collagen & fibroblast activity; good for resistant keloids
Tamoxifen	Anti-estrogenic; ↓ TGF-β	Experimental; topical/injectable forms
Mitomycin C	DNA cross-linker	Topical post-excision use; rare
ACE inhibitors (e.g., enalapril)	↓ Angiotensin II → ↓ fibrosis	Early-stage data; experimental
Insulin	↑ Keratinocyte migration, ↓ inflammation, modulates TGF-β1	Topical or intralesional shown to enhance wound healing and reduce scar formation

VI. TREATMENT ALGORITHM

- Mild (<2 cm) → ILK + silicone → add 5-FU if no response
- Moderate (2–4 cm) → ILK + 5-FU ± cryotherapy; consider laser
- Large/resistant (>4 cm) → excision + post-op radiation ± ILK maintenance

General principles:

- **Avoid excision alone** → Highest recurrence
- **First-line combo**: ILK + 5-FU
- **Best prevention**: Silicone gel + early ILK
- **For ear keloids**: Excision + compression earrings ± ILK
- **For post-shave PFB/AKN**: Treat inflammation (topicals steroids, antibiotics) + ILK early

VII. PREVENTION STRATEGIES

- Avoid elective procedures in at-risk areas (e.g., chest, shoulders, jawline)
- Use silicone sheeting post-surgery and consider ILK immediately post-op in predisposed/high-risk patients
- Manage PFB and AKN early to prevent progression to keloid; early treatment of acne, folliculitis
- Hair grooming education in PFB-prone individuals (avoid close shaving)

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