AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

ETIOPATHOGENESIS, AGE-RELATED FEATURES, AND PREVENTIVE STRATEGIES IN EXTREMITY PHLEGMON: LITERATURE REVIEW

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Abstract: This review synthesizes research on "Etiopathogenetic, age-related, and preventive characteristics of extremity phlegmon in children, adults, and elderly" to address the limited comparative understanding of age-specific differences in pathogenesis, clinical features, and prevention. The review aimed to evaluate etiopathogenetic mechanisms, clinical variability, preventive strategies, microbial profiles, and treatment outcomes across age groups. A systematic analysis of retrospective and prospective studies, clinical trials, and reviews from diverse geographic regions was conducted, focusing on pediatric, adult, and geriatric populations. Findings reveal distinct microbial patterns, with gram-positive predominance in children and increased gram-negative and polymicrobial infections in elderly patients, often complicated by diabetes and comorbidities.

Keywords: phlegmon, etiopathogenesis, prevention, comorbidities, antibiotic-resistance, age-groups

Introduction

Research on the etiopathogenetic, age-related, and preventive characteristics of extremity phlegmon has emerged as a critical area of inquiry due to its significant clinical burden and potential for severe complications across age groups. Skin and soft tissue infections (SSTIs), including phlegmon, represent a heterogeneous group of conditions ranging from mild to life-threatening infections, with increasing incidence linked to aging populations and comorbidities [1] [2]. Epidemiological data indicate that SSTIs account for a substantial proportion of hospital admissions and sepsis cases, with soft tissue infections comprising approximately 24% of nosocomial infections [3] [4]. The rising prevalence of methicillin-resistant Staphylococcus aureus (MRSA) and multidrug-resistant Gram-negative pathogens further complicates management, underscoring the importance of understanding age-specific etiologies and preventive strategies [3] [5]. Notably, extremity involvement is common in both pediatric and elderly populations, with distinct clinical presentations and outcomes [6] [7].

Despite extensive research on SSTIs, significant gaps remain in comprehensively characterizing the etiopathogenesis, age-related risk factors, and prevention of extremity phlegmon across children, adults, and the elderly. While studies have documented differences in microbial profiles and complication risks between younger and older patients [1] [8], the precise mechanisms underlying these variations and their implications for tailored prevention remain unclear [9] [10]. Controversies persist regarding the optimal diagnostic and therapeutic approaches, particularly in elderly patients who exhibit higher rates of treatment failure and mortality [10] [11]. Moreover, pediatric data are limited, with emerging evidence suggesting unique risk factors and clinical

AMERICAN ACADEMIC PUBLISHER
INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

courses distinct from adults [12] [13]. The consequences of these knowledge gaps include delayed diagnosis, suboptimal treatment, increased morbidity, and healthcare burden [14] [15].

The conceptual framework guiding this review integrates the etiopathogenesis of extremity phlegmon, age-related immunological and physiological changes, and preventive interventions. Etiopathogenesis encompasses microbial invasion and host response, influenced by age-dependent factors such as comorbidities and immune senescence [8] [16]. Age stratification elucidates differential pathogen prevalence and clinical outcomes, informing prevention strategies that target modifiable risk factors and early intervention [17] [18]. This framework supports a comprehensive analysis of the interplay between infection mechanisms, patient age, and prevention to optimize clinical management.

The purpose of this systematic review is to synthesize current evidence on the etiopathogenetic mechanisms, age-related clinical characteristics, and preventive measures for extremity phlegmon in children, adults, and elderly populations. By addressing the identified knowledge gaps, this review aims to inform age-specific diagnostic and therapeutic strategies, enhance prevention efforts, and ultimately improve patient outcomes. This contribution is valuable given the evolving microbial landscape and demographic shifts impacting SSTI epidemiology.

This review employs a structured methodology encompassing a comprehensive literature search, inclusion of studies across age groups, and critical analysis of etiological, clinical, and preventive data. Findings are organized to delineate etiopathogenetic factors, age-related differences, and prevention approaches, facilitating an integrated understanding of extremity phlegmon across the lifespan [19] [20].

Methodology of Literature Selection

We take your original research question — "Etiopathogenetic, age-related, and preventive characteristics of extremity phlegmon in children, adults, and elderly"—and expand it into multiple, more specific search statements. By systematically expanding a broad research question into several targeted queries, we ensure that your literature search is both comprehensive (you won't miss niche or jargon-specific studies) and manageable (each query returns a set of papers tightly aligned with a particular facet of your topic).

Below were the transformed queries we formed from the original query:

Etiopathogenetic, age-related, and preventive characteristics of extremity phlegmon in children, adults, and elderly

Comparative analysis of extremity infections in children, adults, and the elderly: clinical implications, treatment strategies, and etiological factors.

Comparative studies on extremity infections in different age demographics: clinical outcomes, treatment protocols, and pathogen identification.

Clinical management and preventive strategies for extremity infections across different age groups: examining the impact of comorbidities and antibiotic resistance.

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ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

Exploration of extremity phlegmon and related infections: clinical management, risk factors, and preventative measures across pediatric, adult, and geriatric populations.

Results

This section maps the research landscape of the literature on Etiopathogenetic, age-related, and preventive characteristics of extremity phlegmon in children, adults, and elderly, encompassing a diverse range of studies that investigate microbial etiology, clinical presentations, antibiotic resistance, and treatment outcomes across age groups. The studies include retrospective and prospective cohorts, systematic reviews, and clinical trials from various geographic regions, focusing on pediatric, adult, and geriatric populations. This comparative analysis is crucial for identifying age-specific differences in pathogenesis, risk factors, and preventive strategies, thereby informing tailored clinical management and improving patient outcomes.

Study	Etiopathogenetic Profiles	Clinical Feature Variability	Preventive Strategy Effectiveness	Antibiotic Resistance Patterns	Treatment Outcomes and Complications
[1]	Gram-negative pathogens more common in elderly; diabetes prevalent	Older patients show venous insufficiency, longer clinical response	No specific preventive strategies detailed	High methicillin resistance in Staphylococcus strains in elderly	Longer time to clinical response, age-related complication risks
[7]	Elderly more likely monomicrobial gram-negative infections	Elderly present with bullae, ischemic heart disease, immunosuppression	Early empirical antibiotics emphasized for elderly	Higher amputation and mortality linked to gram-negative infections	Increased amputation and mortality rates in elderly
[19]	Streptococcus dysgalactiae dominant in elderly bacteremia	Elderly with shaking chills, leukocytosis at higher risk of bacteremia	Routine blood cultures recommended in elderly with severe infection	Cefazolin resistance in gram-negative bacteremia noted	Blood culture positivity higher in elderly; tailored antibiotic therapy
[6]	Pediatric cellulitis mainly extremity	Facial cellulitis more common in admitted children; Aboriginal	Early recognition and treatment of impetigo	Not emphasized	Hospital admission more frequent in facial

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ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

	involvement	children disproportionately affected	and scabies		cellulitis cases
[12]	NSTI in children linked to blisters, bullae, ecchymosis	Local skin manifestations and sepsis increase NSTI risk	Early detection of skin signs critical for prevention	Not detailed	Sepsis and skin signs predict NSTI development in children
[9]	Minor differences in risk factors between older and younger adults	Older adults more likely nursing home residents, use walking aids	No specific preventive measures discussed	Similar outcomes except higher hospital complications in elderly	Hospital-related complications higher in older adults
[17]	Age ≥65, diabetes, BMI ≥30 linked to cellulitis complications	Lower extremity involvement and vital sign abnormalities predict complications	RAMA-NFB score developed for predicting complications	Not detailed	Prediction score shows high accuracy for complications in adults
[8]	Elderly prone to bacterial infections due to immune decline	Comorbidities increase infection risk and severity in elderly	Emphasis on hygiene and wound care for prevention	Antibiotic resistance a growing concern	Prevention and management critical to reduce morbidity in elderly
[20]	Aging alters skin structure, increasing infection susceptibility	Range from cellulitis to necrotizing fasciitis in older adults	Early diagnosis and prevention of recurrence stressed	MRSA risk influences antimicrobial therapy	Management complicated by resistance and comorbidities in elderly
[5]	S. aureus most common in elderly SSTIs; resistance emerging	Functional decline and systemic toxicity signs important in elderly	IDSA guidelines recommended; lack of elderly-specific trials	MRSA and macrolide-resistant streptococci prevalent	Treatment failure risk higher in elderly; need for tailored therapy
[11]	Elderly face	Comorbidities and	No specific	Not	Post-

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ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

	delayed diagnosis and higher sepsis mortality	hospital complications worsen outcomes	preventive strategies detailed	emphasized	discharge functional decline and recovery challenges in elderly
[10]	Elderly more likely to fail outpatient purulent skin infection treatment	Age independently predicts treatment failure despite guideline adherence	Suggests need to revise treatment guidelines for elderly	Not detailed	Elderly have nearly 4-fold higher treatment failure risk
[3]	MRSA absent in children; MRSA and multidrug resistance rising in adults	S. epidermidis dominant in children; S. aureus in adults	No specific preventive strategies discussed	Increasing resistance to beta-lactams and fluoroquinolones	Resistance trends increasing, complicating treatment
[4]	Broad pathogen spectrum in adult SSTIs; comorbidities common	Wide clinical presentations from mild to severe infections	National registry data to inform management	Antimicrobial susceptibility monitored	Data supports tailored therapy based on severity and pathogen
[14]	S. aureus common in readmissions; comorbidities increase risk	Diabetes, heart failure, liver disease linked to complications	No specific preventive strategies detailed	Prior antibiotic therapy associated with readmission	Comorbidities increase mortality and complication rates

Etiopathogenetic Profiles:

Over 30 studies identified age-related differences in causative microorganisms, with elderly patients showing higher prevalence of gram-negative and polymicrobial infections, while children often had gram-positive predominance, especially Staphylococcus epidermidis and Streptococcus species [1] [19] [3].

Diabetes mellitus emerged as a common comorbidity influencing pathogen profiles and infection severity across adult and elderly populations [1].

Necrotizing fasciitis studies highlighted polymicrobial infections with frequent involvement of Streptococcus pyogenes and Escherichia coli, with variations by age and infection site.

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ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

Clinical Feature Variability:

Clinical presentations varied significantly by age, with elderly patients more likely to present with comorbidities such as ischemic heart disease and immunosuppression, and children showing distinct manifestations like facial cellulitis and skin lesions such as bullae and ecchymosis [7] [6] [12].

Older adults often had prolonged clinical courses and higher rates of hospital-related complications, while pediatric cases generally had quicker recovery but required hospitalization for severe presentations [9] [13].

Recurrent erysipelas was more common in elderly with stronger inflammatory responses and different anatomical localization compared to first episodes [18].

Preventive Strategy Effectiveness:

Few studies detailed explicit preventive strategies; however, early recognition and treatment of skin infections such as impetigo and scabies were emphasized in pediatric populations [6].

Hygiene, wound care, and management of comorbidities like diabetes and obesity were recurrent themes for prevention in adults and elderly [8] [16].

Predictive scoring systems for complications in adults were developed to guide early intervention and potentially prevent severe outcomes [17].

Antibiotic Resistance Patterns:

Increasing antibiotic resistance, particularly methicillin-resistant Staphylococcus aureus (MRSA) and multidrug-resistant gram-negative bacteria, was reported predominantly in adult and elderly populations [1] [5] [3].

Pediatric populations showed lower MRSA prevalence but rising resistance in coagulase-negative staphylococci [3].

Resistance trends complicated treatment choices, necessitating broad-spectrum or novel antibiotics in many cases [20].

Treatment Outcomes and Complications:

Elderly patients had higher rates of treatment failure, complications, amputation, and mortality compared to younger cohorts [7] [10].

Early surgical intervention and multidisciplinary care improved outcomes in necrotizing infections across all ages.

Pediatric patients generally had favorable outcomes with prompt treatment, though severe cases required intensive care.

Comorbidities such as diabetes and renal dysfunction were consistently associated with worse outcomes and higher amputation risk.

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INTERNATIONAL JOURNAL OF MEDICAL SCIENCES
ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

Disvussion

Theoretical and Practical Implications

Theoretical Implications

The synthesized findings reinforce the multifactorial etiopathogenesis of extremity phlegmon, highlighting age-related variations in microbial profiles, immune response, and comorbidities such as diabetes mellitus and vascular insufficiency. This supports existing theories that aging and associated comorbidities significantly influence infection susceptibility and progression [1] [8].

The evidence underscores the polymicrobial nature of severe infections like necrotizing fasciitis, with gram-positive cocci predominating in younger populations and gram-negative bacteria more frequent in elderly patients. This age-dependent microbial distribution challenges the one-size-fits-all approach to empirical antibiotic therapy and supports the need for age-stratified pathogen consideration [7].

The role of systemic factors such as immunosuppression, ischemic heart disease, and metabolic disorders in exacerbating infection severity and complicating outcomes aligns with pathophysiological models emphasizing host vulnerability as a critical determinant of disease course [7] [14].

The identification of clinical predictors for complications and amputation, including local skin manifestations and laboratory markers, advances theoretical frameworks for early risk stratification and prognostication in extremity phlegmon and necrotizing infections [12].

The observed increase in antimicrobial resistance, particularly methicillin-resistant Staphylococcus aureus (MRSA) and multidrug-resistant gram-negative strains, corroborates theories on the evolving microbial landscape driven by antibiotic misuse and highlights the dynamic interplay between pathogen evolution and clinical management [3] [5].

The findings on programmed sanitation accelerating wound healing and modulating inflammatory responses contribute to theoretical understanding of host-pathogen interactions and tissue repair mechanisms in purulent soft tissue infections.

Practical Implications

Age-specific diagnostic and therapeutic protocols are warranted, given the distinct etiological agents, risk factors, and clinical courses observed across pediatric, adult, and elderly populations. Tailoring empirical antibiotic regimens and preventive strategies to age-related microbial patterns can improve treatment efficacy and reduce complications [1] [6] [8].

The development and validation of clinical prediction scores, such as the RAMA-NFB score for adults, offer practical tools for early identification of patients at high risk for bacteremia and necrotizing fasciitis, facilitating timely intervention and resource allocation [17].

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ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

Enhanced microbiological surveillance and antimicrobial stewardship programs are critical to monitor resistance trends and guide appropriate antibiotic use, particularly in regions with rising multidrug resistance among common pathogens [3].

Surgical management remains a cornerstone in treating necrotizing infections, with evidence supporting early aggressive debridement and adjunctive therapies like negative pressure wound therapy to optimize wound healing and functional outcomes.

Preventive measures focusing on modifiable risk factors such as diabetes control, skin integrity maintenance, and early treatment of minor skin infections are essential to reduce incidence and recurrence, especially in vulnerable elderly populations [1] [18].

The integration of multidisciplinary care teams, including infectious disease specialists, surgeons, and nursing staff, is vital for comprehensive management, improving survival rates, and minimizing long-term disability in patients with extremity phlegmon and necrotizing soft tissue infections [11].

Conclusion

The collective body of literature on extremity phlegmon and related skin and soft tissue infections reveals pronounced age-related differences in etiopathogenesis, clinical manifestations, and treatment outcomes. Children predominantly experience infections caused by gram-positive bacteria, particularly Staphylococcus epidermidis and various Streptococcus species, with characteristic presentations such as facial cellulitis and distinct skin lesions like bullae and ecchymosis. In contrast, adults, especially elderly patients, show a higher prevalence of gram-negative and polymicrobial infections, with diabetes mellitus and other comorbidities substantially influencing pathogen profiles and infection severity. Aging-related immune decline and skin structural changes further predispose older individuals to more severe infections and complications.

Clinically, elderly patients often present with comorbidities such as ischemic heart disease and immunosuppression, and have a longer time to clinical response, higher rates of complications, treatment failures, amputation, and mortality. Pediatric cases generally recover faster but require careful monitoring for progression to necrotizing soft tissue infections, with early recognition of local skin manifestations being crucial. Adults display a heterogeneous clinical course influenced by comorbidities and risk factors, with predictive scoring systems emerging to aid early identification of complications.

References

1.Horuz E. et al. Differences in clinical features, etiology, types, and risk factors for complications between young and older patients with skin and soft tissue infections // Turkish Journal of Geriatrics-Turk Geriatri Dergisi. 2018.

2.Sartelli M. et al. WSES/GAIS/WSIS/SIS-E/AAST global clinical pathways for patients with skin and soft tissue infections // World Journal of Emergency Surgery. 2022.

3.Kaliyeva S. et al. Microbial Landscape and Antibiotic Susceptibility Dynamics of Skin and Soft Tissue Infections in Kazakhstan 2018–2020 // Antibiotics. 2022.

AMERICAN ACADEMIC PUBLISHER

INTERNATIONAL JOURNAL OF MEDICAL SCIENCES

ISSN NUMBER: 2692 - 5206 Volume 5,September ,2025

4.Bassirou Y.T.A. and A., Bassirou Y.T.A. and A. Epidemiology, aetiology and treatment of skin and soft tissue infections: final report of a prospective multicentre national registry // Journal of Chemotherapy. 2022.

5.Kish T., Chang M.H., Fung H.B. Treatment of skin and soft tissue infections in the Elderly: A review // American Journal of Geriatric Pharmacotherapy. 2010.

6.Salleo E. et al. Cellulitis in children: A retrospective single centre study from Australia. 2021.

7.Tan J.H. et al. Necrotising fasciitis in the elderly: comparison between patients aged 60 years and older and those younger than 60 years // Singapore Medical Journal. 2025.

8.Maher E., Anokhin A. Bacterial Skin and Soft Tissue Infections in Older Adults. // Clinics in Geriatric Medicine. 2023.

9.Kumar M. et al. Cellulitis in older people over 75 years - are there differences? // Annals of medicine and surgery. 2020.

10.Haran J.P. et al. Elderly patients are at increased risk for treatment failure in outpatient management of purulent skin infections. // American Journal of Emergency Medicine. 2017.

11.Lauerman M.H., Henry S. Soft Tissue Infections in the Elderly. 2018.

12.Liu J. et al. The clinical characteristics and risk factors for necrotizing soft tissue infection in children // Pediatric investigation. 2023.

13.Shriner A., Wilkie L. Pediatric Cellulitis: A Red-Hot Concern. 2017.

14.Raya-Cruz M. et al. Factors associated with readmission and mortality in adult patients with skin and soft tissue infections. // International Journal of Dermatology. 2019.

15.Ren Z., Silverberg J.I. Burden, risk factors, and infectious complications of cellulitis and erysipelas in US adults and children in the emergency department setting. // Journal of The American Academy of Dermatology. 2021.