

# Erythrodermic Psoriasis: Excellent Response to Skin Treatment with Ozonated Water, through the Use of a Patented Robotic Therapy System for the Surveillance and Prevention of Hospital Infections

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## Abstract

**Background:** Erythrodermic psoriasis (EP) is a rare, severe variant of psoriasis characterized by widespread erythema, scaling, and systemic complications. Despite advances in systemic treatments, the management of EP remains challenging, particularly in patients with comorbidities or contraindications to standard therapies. **Objectives:** To evaluate the effectiveness of ozonated water as an adjunctive treatment for EP, delivered using a patented robotic therapy system designed for hygiene and infection prevention in non-self-sufficient patients. **Methods:** We report the case of a 90-year-old male patient with acute EP who received daily skin treatments with ozonated water in conjunction with supportive care, including rehydration and antibiotics. The intervention was facilitated by the robotic system “COPERNICO Surveillance & Prevention,” which ensured standardized hygiene practices and clinical documentation. **Results:** Within one week of treatment, the patient showed complete desquamation of necrotic skin, resolution of erythema, and significant metabolic recovery. Fever subsided, renal function improved, and the patient was discharged in stable condition. Follow-up confirmed sustained clinical improvement, and no adverse events were reported. **Conclusions:** Ozonated water demonstrated efficacy in alleviating the dermatological and systemic manifestations of EP in a high-risk elderly patient. This case highlights the potential of ozone therapy as a safe, cost-effective adjunctive treatment for EP and underscores the utility of robotic systems in managing complex dermatological conditions. Further research is warranted to validate these findings in larger cohorts.

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## Keywords

Erythrodermic Psoriasis, Ozone Therapy, Infection Prevention, Patient Hygiene, Dermatological Care, Robotic-Assisted Hygiene

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## 1. Introduction

Erythrodermic psoriasis (EP) is a rare but severe form of psoriasis, affecting approximately 1% to 2.25% of psoriasis patients. Characterized by extensive erythema, scaling, and systemic symptoms, EP often involves more than 75% of the body surface area and can be life-threatening. This condition is frequently precipitated by abrupt withdrawal of systemic medications, infections, or physical and emotional stress, leading to complications such as hypothermia, electrolyte imbalances, and secondary infections, which often necessitate hospitalization [1]. Infection is the most common adverse event [2]. Severe cases of EP can result in complications such as septic shock and mycotic aneurysms, as the extensive loss of epidermal function increases risks for opportunistic infections and electrolyte imbalances [2]. Such severe presentations underscore the urgent need for effective treatment approaches [3]. The pathophysiology of EP remains largely unknown but is thought to differ from that of plaque psoriasis, adding complexity to its treatment, which is often guided by clinical experience and patient comorbidities [3]. Traditional therapeutic approaches for EP involve systemic immunosuppressants, biologics, and supportive care [4]. While effective, these options carry the risk of adverse effects, especially in immunocompromised patients, emphasizing the need for adjunctive or alternative therapies. Combination therapy has been shown to improve outcomes compared to single-agent approaches [2]. Although recent advances in targeted treatments provide new options, EP's unpredictable nature limits their applicability, leading to varied outcomes [3]. Ozone therapy has emerged as a potential adjunctive treatment for a variety of dermatological conditions, including chronic wounds, burns, and inflammatory skin diseases [5]. Ozone ( $O_3$ ) is known for its oxidative properties, and when used topically at controlled concentrations, it can modulate immune responses, enhance tissue oxygenation, and exhibit broad-spectrum antimicrobial activity [6]. Topical ozonated water, specifically, has shown potential as a low-cost, non-invasive intervention with minimal side effects, making it a promising candidate for EP supportive care [5]. Mechanistically, ozone's therapeutic effects are attributed to the generation of reactive oxygen species (ROS) and lipid oxidation products (LOPs), which activate cellular antioxidant responses via nuclear factor erythroid 2-related factor 2 (Nrf2) and inhibit inflammatory cascades mediated by nuclear factor kappa B (NF- $\kappa$ B) [5]. Additionally, the antimicrobial properties of ozonated water may help prevent secondary infections in EP, offering a dual benefit in inflammation control and infection prevention [6]. Studies suggest that topically applied  $O_3$  liquids pose a low short-term risk to human skin [7]. This case report explores the

application of ozonated water in the management of erythrodermic psoriasis, focusing on its role as an adjunctive treatment to alleviate symptoms and enhance patient quality of life. By presenting this case, we contribute to the growing body of evidence supporting ozone therapy as a safe and effective modality in dermatological care.

## 2. Case History

**Table 1.** Patient clinical picture upon admission.

Parameter	Value
Temperature	38°C
Heart Rate (HR)	Not specified
Blood Pressure (BP)	Not specified
Respiratory Rate (RR)	Not specified
Fever	Present
Vision	Blurred
Dehydration	Present
Anuria	Present
Hemoglobin (Hb)	9.2 g/dL
Neutrophils	13,000/mm <sup>3</sup>
Uricemia	7.7 mg/dL
Albuminemia	2.2 g/dL
Creatinine	2.1 mg/dL
C-Reactive Protein (CRP)	18.3 mg/L
Procalcitonin	0.1 µg/L
Imaging	No significant findings in CT
ECG	Unremarkable

A 90-year-old Jewish man, who has been residing in Italy for many years, was admitted to the hospital for the explosive onset, with almost total dissemination, of a severe form of Erythrodermic Psoriasis (EP), as the first manifestation of the disease, two months after undergoing radical surgery for bladder cancer. The patient had no prior history of psoriasis or other significant dermatological conditions. The skin lesions progressed very rapidly, accompanied by a significant clinical worsening. The patient, who was also suffering from insulin-dependent diabetes mellitus, was diagnosed by a dermatology specialist with a severe form of EP and recommended for hospitalization due to the extreme severity of the clinical picture; therapy with systemic steroids and/or monoclonal antibodies was not recommended due to the risk of serious side effects, particularly in an elderly patient with multiple comorbidities. Standard treatments involving cleansing and management of skin lesions had not yielded any benefits. Upon admission, the patient

presented an extremely compromised clinical condition from both general and metabolic perspectives as it is shown in **Table 1**.

Appropriate therapy was initiated, including controlled rehydration to address the dehydration and renal impairment, and antibiotic therapy to prevent septic complications from potential skin infections. This was complemented by total bed hygiene, which was enhanced by local treatment with ozonated water. In our patient, the microbiological examination of skin swabs and blood cultures showed no bacterial growth, and the value of procalcitonin was normal, confirming the absence of septic overlap.

The treatment regimen was repeated daily for one week and resulted in the complete desquamation of the necrotic skin, with the disappearance of plaques and areas of redness, leading to a significant improvement in the skin condition. Concurrently, the metabolic, renal, and cerebral conditions returned to near normal. The patient's fever subsided, and renal function improved, as evidenced by decreasing creatinine levels and the resolution of anuria. The patient was discharged, significantly improved from a metabolic point of view, with a sensorium comparable to that recorded before the onset of the disease. The photographs illustrate the evolution of the skin lesions before and after a week of treatment (**Figure 1**).



**Figure 1.** Patient skin condition before and after one week of treatment using ozonized water and rigorous hygiene practices.

The consultant dermatologist who examined the patient in the clinic confirmed the diagnosis of EP. The normal eosinophil count, the absence of bacterial growth from the skin swab, and the lack of recent drug intake excluded other possible diagnoses such as drug-induced erythroderma or atopic dermatitis. The patient consented to the publication of this report, and the family expressed an enthusiastic evaluation of the care received, particularly appreciating the therapeutic response to the skin treatment used. They were particularly impressed with the non-invasive nature of the treatment and the rapid improvement observed.

The assisted robot used to treat the patient with EP was the “COPERNICO Surveillance & Prevention,” produced by Primed Corporation, patented and covered by the World Intellectual Property Organization (WIPO) since 2024, and in use at the hospital for a project on intervention and prevention of infections in non-self-sufficient patients. The robot, managed by two qualified healthcare workers, includes a computer system capable of recording and archiving the patient’s clinical data and images relating to the skin condition or the presence of any form of bedsores. The sequence of the hygiene treatment performed, using cleaning products such as soapy wipes and a medicated toothbrush, adheres to best practices and is recorded on a certificate at the end of each treatment; this certificate is then inserted into the clinical documentation [8].

### 3. Discussion

Psoriasis is the most common cause of erythroderma in adults [9], accounting for up to 25% of cases. In severe cases, such as that of our patient, it can lead to complications including hypoalbuminemia, peripheral edema, renal failure, and fever [10], all of which underscore the critical nature of this condition. Other causes of erythroderma include atopic dermatitis, drug reactions, cutaneous lymphoma, and other inflammatory skin diseases. The evolution of our patient’s skin lesions and overall clinical picture demonstrate the effectiveness of the therapy used, particularly the use of ozonated water for skin treatment. The rapid improvement in both dermatological and systemic symptoms suggests that the treatment addressed not only the skin manifestations but also contributed to the stabilization of the patient’s overall condition. Helping patients maintain personal hygiene is a fundamental aspect of nursing care, and bed bathing is a recognized and effective system for the complete hygiene of bedridden and/or non-self-sufficient patients [11] [12]. This task, delicate in nature, requires qualified personnel and robust technological support, ideally following a checklist as recommended by Silva *et al.* [13]. Proper hygiene is crucial in preventing secondary infections, which can be particularly dangerous in patients with extensive skin involvement. Ozone therapy, considered an innovative treatment strategy, acts through complex mechanisms such as antioxidant effects, immunomodulatory capacity, and improvement of local microcirculation [14] [15]. It has been shown to induce the production of cytokines and growth factors that promote healing and reduce inflammation, making it an increasingly popular alternative for treating skin diseases, particularly psoriasis [15]-[17]. Gao L. *et al.* [18] offer an in-depth analysis of the positive effects of ozone treatment in psoriasis, illustrating how the pathological process in psoriasis lesions—characterized by the rapid proliferation of basal keratinocytes that fail to differentiate fully before reaching the stratum corneum—can be mitigated by ozone therapy. This therapy promotes the differentiation of these basal keratinocytes and the production of keratin 10 (KRT10), which leads to the improvement and potential resolution of psoriatic patches. Given its efficacy and lack of side effects, which are more frequently associated with pharmacological treatments, ozone therapy could be promoted for treating even less

severe forms of psoriasis than those observed in our patient. The use of ozone for the treatment of erythrodermic psoriasis (EP) has the potential to become a safe and effective therapeutic component. However, further studies are needed to confirm these results in other patients with severe skin lesions. Randomized controlled trials and larger case series are crucial to establish the efficacy and safety profile of ozone therapy in this context, offering a significant advancement in dermatological care for challenging cases like EP.

#### **4. Conclusion**

This case report has demonstrated the potential of ozonated water used in conjunction with a robotic hygiene system as a viable, low-risk treatment for managing erythrodermic psoriasis (EP), a severe and potentially life-threatening condition. The rapid and significant improvement in our patient's dermatological and systemic symptoms highlights the efficacy of this innovative approach, particularly in elderly patients with multiple comorbidities who may not tolerate conventional systemic therapies well. Ozone therapy offers a unique combination of antimicrobial, immunomodulatory, and healing properties, making it an attractive adjunctive treatment for EP and possibly other severe dermatological conditions. The integration of this therapy with robotic technology ensures consistent and optimal hygiene management, which is critical for preventing secondary infections in vulnerable patients. Despite these promising results, the application of ozone therapy in EP requires further validation through randomized controlled trials and larger case series to fully establish its efficacy and safety profile. Future research should also explore the mechanistic basis of ozone's effects on skin pathology more extensively, potentially broadening its application to other inflammatory and infectious skin diseases. By pushing the boundaries of traditional dermatological treatments, this case encourages a reevaluation of current treatment protocols and underscores the need for continued innovation in the management of complex skin diseases.

#### **Authors' Contributions**

Linda Pasta: As the main author, Linda directed the clinical team and oversaw the patient's care throughout their stay at the clinic. She played a pivotal role in conceptualizing and drafting the manuscript. Massimiliano Guastella: Massimiliano contributed to the manuscript by providing critical data insights and validating the clinical data presented. Additionally, he conducted research activity on erythrodermic psoriasis case reports. Maria Stefania Leto Barone: Maria supervised the entire treatment process, evaluated the patient's condition regularly, and was instrumental in documenting the treatment outcomes. Her expertise was crucial in interpreting the clinical implications of the treatment and she contributed significantly to the writing and revision of the manuscript.

#### **Ethical Compliance Statement**

Informed consent was obtained from the patient and his family for the publication

of this case report, including clinical details and images.

## Conflicts of Interest

This manuscript has not been submitted to, nor is under review at, another journal or other publishing venue. The authors have no affiliation with any organization with a direct or indirect financial interest in the subject matter discussed in the manuscript.

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