



Review Article

Stevens-Johnson Syndrome with a 24-Hour Onset Following a Single Dose of Ibuprofen: A Case Report and Review

Rena Raad Helmi¹ , Wassan Nori^{2*} , Zeena Raad Helmi² , Ahmed Atia³

¹Department of Dermatology, College of Medicine, Mustansiriyah University, Baghdad, Iraq; ²Department of Obstetrics and Gynecology, College of Medicine, Mustansiriyah University, Baghdad, Iraq; ³Department of Anesthesia and Intensive Care, Faculty of Medical Technology, University of Tripoli, Libya

Received: 20 September 2025; Revised: 28 October 2025; Accepted: 1 November 2025

Abstract

Stevens-Johnson syndrome (SJS) is a rare, severe mucocutaneous disease. Most commonly triggered by infections or prolonged drug use, and reports of such atypical triggers are limited, here we present a case report of a female patient who developed rapid-onset SJS after a single dose of ibuprofen. A 21-year-old woman attended the Emergency Department (ER) with a diffused erythematous, crusted skin lesion associated with painful oral and genital mucosal erosions 24 hours after a single dose of ibuprofen. She was mildly feverish and anxious; her lab test was unremarkable. In the hospital, she received supportive therapy, local skin care, and systemic steroid 60 mg/kg. She gradually improved, and 10 days after admission, she was discharged home. Even a single dose of ibuprofen can trigger SJS, so clinicians must maintain high vigilance, as early recognition and prompt management are critical to prevent severe complications and improve outcomes.

Keywords: Female, Ibuprofen, Non-steroidal anti-inflammatory drugs, Stevens-Johnson syndrome, Side effect.

ظهور متلازمة ستيفنز-جونسون بعد 24 ساعة من جرعة واحدة من الإيبوبروفين: تقرير حالة ومراجعة

الخلاصة

متلازمة ستيفنز-جونسون (SJS) مرض نادر وخطير يصيب الجلد والأغشية المخاطية. غالبًا ما يُحفَّز بواسطة العدوى أو الاستخدام المطول للأدوية، بينما تظل التقارير عن مثيرات غير نمطية محدودة. في هذا التقرير نعرض حالة لامرأة أصيبت بظهور سريع لمتلازمة ستيفنز-جونسون بعد تناول جرعة واحدة فقط من الإيبوبروفين. حضرت امرأة تبلغ من العمر 21 عامًا إلى قسم الطوارئ بطفح جلدي منتشر متحمر ومتقشر، ترافق مع تآكلات مؤلمة في الأغشية المخاطية الفموية والتناسلية، وذلك خلال 24 ساعة من تناولها جرعة واحدة من الإيبوبروفين. كانت تعاني من حمى خفيفة وقلق، فيما أظهرت الفحوص المخبرية نتائج طبيعية. أثناء دخولها المستشفى تلقت علاجًا داعمًا، عناية موضعية بالجلد، وجرعة من الستيرويد النظامي (بريدنيزولون 60 ملغ/يوم؛ 1 ملغ/كغ/يوم). تحسنت حالتها تدريجيًا، وبعد عشرة أيام من الدخول غادرت المستشفى بحالة مستقرة. تشير هذه الحالة إلى أن جرعة واحدة فقط من الإيبوبروفين قد تكون كافية لتحفيز متلازمة ستيفنز-جونسون، مما يفرض على الأطباء درجة عالية من اليقظة، حيث يُعد التعرف المبكر والتدخل العلاجي السريع أمرين حاسمين للوقاية من المضاعفات الشديدة وتحسين المآلات.

* **Corresponding author:** Wassan Nori, Department of Obstetrics and Gynecology, College of Medicine, Mustansiriyah University, Baghdad, Iraq; Email: dr.wassan76@uomustansiriyah.edu.iq

Article citation: Helmi RR, Nori W, Helmi ZR, Atia A. Stevens-Johnson Syndrome with a 24-Hour Onset Following a Single Dose of Ibuprofen: A Case Report and Review. *Al-Rafidain J Med Sci.* 2025;9(2):216-221. doi: <https://doi.org/10.54133/ajms.v9i2.2516>

© 2025 The Author(s). Published by Al-Rafidain University College. This is an open access journal issued under the CC BY-NC-SA 4.0 license (<https://creativecommons.org/licenses/by-nc-sa/4.0/>).



INTRODUCTION

Stevens-Johnson syndrome SJS is a life-threatening mucocutaneous disease defined by skin exfoliation, mucosa involvement, and blistering. It has an annual incidence of 2-7/million/year. The disease represents an emergency that requires immediate intervention [1]. Triggering factors may be drugs (non-steroidal anti-inflammatory drugs (NSAIDs), antibiotics, and anticonvulsants) or infection (CMV, EBV, Mycoplasma pneumonia, HIV) [2]. Drugs account for most cases via immune-mediated keratinocytes. SJS manifests as fever, malaise, and respiratory signs that will rapidly progress to painful target lesions and extensive sloughing of skin. Clinical characteristics with less than 10% of the body involved confirm the diagnosis. SJS has high morbidity and tends to have short- and long-term complications, including acute sepsis, multiorgan failure, chronic ocular

scarring, and oral stricture. The mortality rate is 1-5%, as predicted by the SCORTEN scale [3]. Recovery takes 2-6 weeks, and full skin healing takes months. Ibuprofen, an NSAID class, is widely used with a good safety profile; however, there are rare case reports of severe SJS following its intake. Here we present a report of a young female who suffered a severe form of SJS following a single dose of ibuprofen intake, which underscores the uncommon drug hypersensitivity reaction and the importance of early recognition and timely intervention. We aim to improve public awareness of this complication linked with over-the-counter medication.

Case Presentation

21-year-old women were admitted to the emergency unit of Al-Yarmouk Hospital in Baghdad, Iraq, with

complaints of the sudden onset of erythematous crusted lesions involving the whole body, especially on the face, chest, limbs, and mucous membrane, that made eating and drinking impossible for a few days. She gave a history of taking Ibuprofen 400 mg as a single dose 24 hr prior to admission, prescribed by a rheumatology specialist who prescribed it for the patient due to non-specific back pain. Past medical, surgical, and drug history was unremarkable. She had a negative history of smoking and drinking. On physical examination, she was severely anxious and dehydrated and had a body mass index of 26.6. Her vital signs were normal: BP 110/70 mmHg, PR 130 beats/minute, RR 16 breaths/minute, SPO2 98%, and she was mildly feverish (38°C). Local examination of skin lesions revealed that body surface area (BSA) affected by epidermal detachment was 20%; the lesion appeared on her trunk, then spread to the neck, face (except the eyes, which were normal), and proximal upper extremities. One of the earliest sites to get involved was Palms and Soles. Erythema and erosions affected both the buccal and genital mucosa. The skin lesions upon local examination were tender, as were the mucosal erosions. The skin lesions appeared as erythematous, dusky red, or purpuric macules of diverse size and shape with a tendency to coalesce. The early macular lesions have a dusky center, with a target appearance illustrated in Figure 1. The patient was admitted to the hospital. A blood sample was withdrawn for laboratory tests, including a complete blood count, renal and liver function tests, and serum electrolytes, as well as a general urine exam.



Figure 1: Patient presenting symptoms 24 hours after drug intake. A) hemorrhagic crusts of the lips, mucosal involvement, as well as macular and bullous cutaneous lesions. B) Generalized erythematous plaques with dusky centers. C) Typical target lesions and vesiculobullous lesions on the palm. D) Numerous dusky red macular eruptions with flaccid bullae, and a few sites of epidermal detachment. E) Erythematous plaques; coalescence of the lesions on the palm.

All were normal apart from (+ 1) ketone in urine. Based on clinical history and physical examination, the patient was diagnosed with Stevens-Johnson syndrome. The SCORTEN score, according to the presentation, was 2 (moderate SJS) with an estimated 12% mortality rate. We started treatment immediately as described in Table 1. After 10 days of admission alongside therapy, the patient's condition showed dramatic improvement, and they were ready for discharge home.

Table 1: The therapy received by the patient during hospital stay

Intervention	Details	Duration/Notes	Rationale of treatment
Drug discontinuation	Immediate cessation of Ibuprofen	At presentation	It is the corner stone to stop SJS trigger and stop progression
Supportive therapy	IV fluids: 4 units normal saline (0.9%) + 2 units glucose 5%	For 3 days (due to poor oral intake)	To prevent patient dehydration that is a common sequelae of reduced intake caused by oral ulceration and increased loss due to breach in skin barriers
Systemic corticosteroid	Prednisolone: 60 mg/day → tapered to 30 mg (3 days) → then reduced by 10 mg daily.	Total course: ~10 days	Though there is controversy in their use, they are still recommended by many studies in acute state when given promptly and less severe forms of SJS
Wound care	- Topical Fusidic acid (Fucidin) ointment is used for the face. - serous crusts are cleaned daily with isotonic sterile sodium chloride solutions. - An antibiotic ointment is applied around orifices (ears, nose, mouth). - silicone dressings are used to cover some erosive denuded areas of skin.	During hospitalization	To reduce wound secondary infection; to enhance wound healing. Silicone dressings reduce pain and safeguard denuded area

The erythematous maculopapular rash began to improve progressively with a gradual reduction in severity each day. Shown in Figure 2. The observed clinical improvement demonstrates the effectiveness of the treatment throughout the patient's hospitalization. Although ibuprofen rarely induces Stevens-Johnson Syndrome, careful use is recommended.

DISCUSSION

This case is a report of a young female who suffered severe SJS following a single dose of Ibuprofen intake, while other cases of SJS were reported in the literature;

however, most of them were following repeated intake, which makes the appearance of the SJS after a single dose exceptionally uncommon. Moreover, this case showed a rapid and severe reaction, which usually takes days to weeks. The abrupt mucocutaneous involvement implies a unique immunological susceptibility that calls for further studies. The rapid onset of the SJS syndrome following a single-dose exposure implies a previous exposure and immunological sensitization (amnestic recall reaction) rather than an initial sensitization. In the former, specific memory T-cells from a previous unrecognized exposure become quickly reactivated and trigger a response within a few hours, which is the most

likely scenario in the current case. So it is the immune cells' product rather than the drug itself that drives SJS syndrome [4].



Figure 2: Patient presenting symptoms 48 hours after drug intake **A)** Erythematous macules and patches on the face; coalescence of the lesions, no mucosal involvement. **B)** Faint erythematous patches; coalescence of the lesions of the palm with exfoliated skin of the fingers. **C)** Treatment after 7 days. **D)** Mild erythematous macules and patches on the back. **E)** Mild erythematous patches on the palm.

At the molecular level, keratinocyte apoptosis seen in SJS; is triggered by NK cells and cytotoxic T-cells; they release a number of mediators that have been found to be

involved in the extensive epidermal necrosis seen. Granulysin is a primary cytotoxic protein released by these cells and was found to drive extensive epidermal necrosis [5]. Another suggested apoptotic mechanism is perforin-granzyme and the Fas–FasL signalling. These work together to speed up keratinocyte death and are responsible for the dramatic clinical deterioration in severe SJS syndrome [6]. It is important to note that the patients' genetic fingerprints further reduce the risk of drug hypersensitivity. It had been reported that the *HLA-B*15:02* allele increases the risk of SJS-induced reaction to carbamazepine among the Han Chinese population. In comparison, the *HLA-A*31:01* allele is the triggering allele, among others [7]. Understanding the impact of genetic print explains why SJS develops in certain populations following exposure to commonly used medications. Although HLA testing was not done in our case, it is important to understand this correlation so future pharmacologic screening may be done for those in the high-risk group. As a drug, ibuprofen-induced SJS is rare, and there are a handful of documented cases, which were summarized and compared in Table 2 to highlight presentation and key notes.

Table 2: Summary of published SJS case reports in the last decade

Author (year)	Patient age	Ibuprofen dose	Latency period	Treatment	Outcome
Park <i>et al.</i> (2022) [8]	32-year-old woman	not reported	Hours after intake	Hospital admission, antihistamines, IV fluids, and pain medication;	Good response, discharge home without further complication
Gui <i>et al.</i> (2021) [9]	Child	They did not report dose only (Ibuprofen suspension)	Not reported	Methylprednisolone 30 mg iv , loratadine 10 mg Reduced GSH Adenosylmethionine succinate Compound glycyrrhizin Ursodeoxycholic	The patient was discharged after the condition gradually stabilized; the liver injury and dermatitis were healed. No major complains
Kumar <i>et al.</i> (2021) [10]	Young child	They did not report dose only it was taken 1 year ago	Not reported	Supportive therapy with oral & ocular rehabilitation	The child suffered chronic ocular complication and visual impairment
Güdeloğlu <i>et al.</i> (2020) [11]	14-year-old female	400-mg tablets 12 hours for two days	2 days	Supportive therapy with oral & ocular rehabilitation(Miconazole oral gel Fucidic acid) plus Systemic steroids; methylprednisolone (900 mg/day)	On the2nd day she begin to improve , 5 th day the lesion start to fade and on the 7 th day of treatment, the patient was discharged and followed out
Abreu <i>et al.</i> (2020) [12]	Infant	Not reported	Not reported	Supportive only especially for oral rehabilitation	The paper was concerned with post recovery analgesic option and did provocative test to guide future pain management for the case.
Bollampally <i>et al.</i> (2017) [13]	2-year-old baby	100mg	4days	Intravenous fluids, oral prednisolone, Fusidic acid cream and liquid paraffin	Good response, discharge home without further complication
Han <i>et al.</i> (2017) [14]	34-year-old female	300mg	1 day	Symptomatic supportive & Glucocorticoids, human gamma globulin	After 2-weeks the symptoms were improved
Angadi <i>et al.</i> (2016) [15]	Nepalese patient	3 doses of 400 mg of Ibuprofen	3 days	Plasma exchange and fluid resuscitation with crystalloid infusions Corticosteroids 0.5 mg/kg body weight Intravenous immunoglobulins (IVIG) 1.0 g/kg body weight/day	After 5-weeks of intensive systemic treatment ;the patient recovered completely

Our case had moderate SJS syndrome according to the SCORTEN score, which is defined as a validated tool for inpatients' mortality risk for SJS cases. These should be estimated 24 hours after the admission [16]. It also helps stratification of therapeutic strategies and evaluates immunomodulation, which ultimately formulates the decision of ICU admission and aggressive therapy implementation. Still, it had limited validity in children

and tended to overestimate mortality rates in some populations [17] (Figure 3). therapy and drug discontinuation in line with international guidelines. Systematic corticosteroids were chosen here because the case was presented early in a moderate disease state, and owing to steroids' broad clinical use and accessibility, they were the first choice.

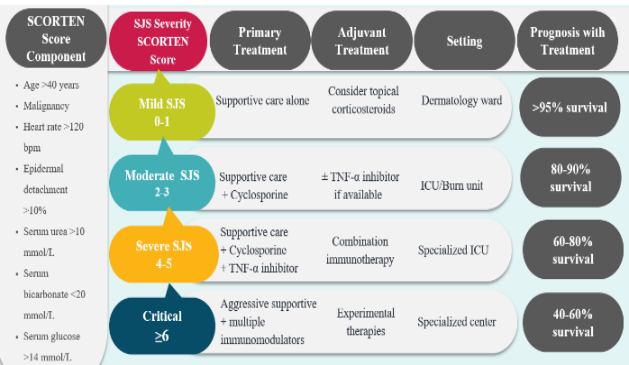


Figure 3: SCORTEN Score component, scoring, severity and prognosis [17].

Our patient paradigm of treatment was supportive; however, the current evidence supports their use when

administered early and tapered appropriately [18]. Conversely, other options like cyclosporine A and TNF-α inhibitors are reserved for established use despite their encouraging results [18]. We have to acknowledge the debatable role of corticosteroids in SJS syndrome owing to increased infection risk and delayed re-epithelialization. Still, the current evidence points out that if they were used early, in moderate doses for non-severe cases (as in our case here, which showed stable lab tests and no organ involvement), and for short periods of time, they are both safe and effective. For that, the steroid was deemed suitable for the case [18]. In Table 3, we have summarized the spectrum of therapy used, ranging from traditional to emerging. A comprehensive review of the therapeutic strategies in SJS was presented in Table 3 [19-28].

Table 3: Therapeutic strategies used in SJS with supporting evidence, action and clinical utility

Treatment Category	Specific Intervention	Evidence Level	Mechanism of Action	Clinical Efficacy & Controversies	Reference
Supportive Care	Multidisciplinary supportive care	Strong	Restoring skin barrier, maintain fluid/electrolyte balance, and prevent infection	High survival benefit	Supportive Care
	Wound care (non-burn approach)	Strong	Maintains skin barrier function	Essential for recovery Specialized center for its use is scare Indirectly reduces mortality rates	[22]
	Fluid/electrolyte management	Strong	Maintains homeostasis	Prevents complications Needs ICU monitoring Indirectly reduces mortality rates	[23]
Immuno-modulatory	Cyclosporine A	Strong	Inhibits CD8+ T-cells, blocks TNF-α	Significant improvement Most promising systemic therapy reduces mortality rates by half	[24]
	TNF-α Inhibitors (Etanercept)	Moderate-Strong	TNF-α blockade, anti-apoptotic	Promising results Yet cost and limited supporting evidence	[25]
	Systemic Corticosteroids	Moderate	Anti-inflammatory, immunosuppression	Controversial No supporting evidence unclear reduces mortality rates	[26]
	Intravenous Immunoglobulin (IVIG)	Moderate	Fas-FasL pathway inhibition	Inconsistent results and have high coast No effect on mortality rates	[27]
Emerging therapies	Fas-FasL pathway inhibitors	Experimental	Direct apoptosis inhibition	Under investigation limited data on human Effect on mortality reduction is unknown	[28]
	Necroptosis inhibitors	Experimental	Alternative cell death pathway	Theoretical benefit Effect on mortality reduction is unknown	[18]
	Targeted biologics	Experimental	Specific immune mediator targeting	Variable No supporting evidence Effect on mortality reduction is unknown	[29]

We have placed therapeutic decisions within a larger clinical context to highlight the diversity of management options. Current best practice guidelines consistently give priority to supportive measures as the cornerstone of treatment. The systemic corticosteroid used as the primary option in our case continues to be a recommended option by many guidelines despite some ongoing controversy. Even though adding immunomodulatory drugs like cyclosporine or TNF-α inhibitors has positive effects, they were not used in this case because they were hard to find where we were and steroids are better for moderate to early cases of SJS.

The possible differential diagnoses for this case include Erythema Multiforme Major, Toxic Epidermal Necrolysis (TEN), and other drug hypersensitivity syndromes. These cases were reviewed based on discriminating criteria [29,18, 30]described in Table 4. The current case is unique in more than one aspect, as one of the over-the-counter medications, ibuprofen, showed a high risk of inadvertent re-exposure, which urges documenting drug allergies. The case was presented with a severe form following a single dose alongside rapid deterioration.

Table 4: Differential diagnosis of SJS syndrome

Differential diagnosis	Distinguishing features	The current case	Ref.
Erythema Multiforme	There should be typical target lesions with 3-concentric zones, which are well demarcated, mainly seen on the extremities and/or the face	Had atypical flat target alongside mucosal erosions	[18]
Major Toxic Epidermal Necrolysis (TEN)	This syndrome is defined by more than 30% skin involvement, confluence erythematous plaque and severe systemic features	The skin detachment was less than 20%	[30]
Other drug hypersensitivity syndromes	It usually has different clinical presentation with fascial edema , lymphadenopathy , visceral organ involvement and eosinophilia	All were absent in our case	[31]

This underscores the necessity of vigilance even with benign drugs and the importance of timely intervention to prevent case progression into toxic epidermal necrolysis (TEN), which carries a high mortality. The key take-home messages here: There is an unpredictable hypersensitivity reaction to a single dose of ibuprofen, which suggests the value of genetic susceptibility that surpasses drug exposure duration and the critical role of thorough medical and drug history in evaluating patient cases. The impact of prompt intervention in preventing patient deterioration. Finally, the value of patient education regarding permanent drug avoidance for ibuprofen. Finally, medical alert identification is of paramount importance.

Conclusion

This case highlights the increased appreciation of ibuprofen hypersensitivity, even with a single-dose exposure, which may lead to a life-threatening response in susceptible cases, underscoring the need for heightened clinical vigilance for NSAIDs, regardless of duration and exposure frequency.

Conflict of interests

The authors declared no conflict of interest.

Funding source

The authors did not receive any source of funds.

Data sharing statement

Supplementary data can be shared with the corresponding author upon reasonable request.

REFERENCES

- Shao Q, Yin X, Zeng N, Zhou Z, Mao X, Zhu Y, et al. Stevens-Johnson syndrome following non-steroidal anti-inflammatory drugs: A real-world analysis of post-marketing surveillance data. *Front Pediatr*. 2022;10:896867. doi: 10.3389/fped.2022.896867.
- Fetriani U, Zakiawati D. Viral triggers exposed: A systematic review of virus-induced Stevens-Johnson syndrome/Toxic epidermal necrolysis. *J Inflamm Res*. 2025;18:12575-12588. doi: 10.2147/JIR.S546186.
- Fletcher G, Ryan D, Bunker C. Association between Stevens-Johnson syndrome and toxic epidermal necrolysis with Ibuprofen: A pharmacovigilance study in the UK Yellow Card scheme and systematic review of case reports. *medRxiv*. 2023;2023.12.05.23299283. doi: 10.1101/2023.12.05.23299283.
- Justice J, Mukherjee E, Martin-Pozo M, Phillips E. Updates in the pathogenesis of SJS/TEN. *Allergol Int*. 2025;74(3):361-371. doi: 10.1016/j.alit.2025.05.002.
- Hasegawa A, Abe R. Stevens-Johnson syndrome and toxic epidermal necrolysis: Updates in pathophysiology and management. *Chin Med J*. 2024;137(19):2294-2307. doi: 10.1097/CM9.0000000000003250.
- Yao LM, Su X, Liu LL, Qi YN, Wei B, Ma R, et al. Recent developments in the research of Stevens-Johnson syndrome and

toxic epidermal necrolysis: pathogenesis, diagnosis and treatment. *Eur J Med Res*. 2025;30(1):453. doi: 10.1186/s40001-025-02664-7.

- Ferrell PB, McLeod HL. Carbamazepine, HLA-B*1502 and risk of Stevens-Johnson syndrome and toxic epidermal necrolysis: US FDA recommendations. *Pharmacogenomics*. 2008;9(10):1543-1546. doi: 10.2217/14622416.9.10.1543.
- Park K, Yeich A, Craig T. An unusual presentation of Stevens-Johnson syndrome (SJS) in a patient with two prior SJS episodes. *Ann Allergy Asthma Immunol*. 2022;129(5):S84. doi: 10.1016/j.anai.2022.08.731.
- Gui M, Ni M, Yin X, Zhang T, Li Z. Ibuprofen induced Stevens-Johnson syndrome and liver injury in children: a case report. *Transl Pediatr*. 2021;10:1737-1742. doi: 10.21037/tp-21-8.
- Kumar N. Stevens-Johnson reaction: A rare case report of ibuprofen-induced hypersensitivity reaction in a young child. *J Pediatr Dent*. 2021;10(69). doi: 10.14744/JPD.2021.10_69.
- Güdeloğlu E, Altan V. A reasonable outcome with systemic corticosteroids in a case of ibuprofen induced Stevens-Johnson syndrome. *Am J Immunol*. 2020;16:27-30. doi: 10.3844/ajisp.2020.27.30
- Abreu S, Castelblanco-Arango I, Gómez-Pineda P, Cardona R. Drug provocation tests to identify analgesic alternatives for an infant with Stevens-Johnson syndrome caused by ibuprofen-acetaminophen. *Rev Alerg Mex*. 2020;67(2):189-95. doi: 10.29262/ram.v67i2.712.
- Bollampally M, Praneeth G, Prithi A. Ibuprofen induced Steven Johnson syndrome. *World J Pharm Med Res*. 2017;3(10):165-167.
- Jian H, Liyun Z, Gailian Z, Ke X, Ruihong H. Ibuprofen sustained-release capsules induced Stevens-Johnson syndrome. *Adverse Drug React J*. 2017;19(5):389. doi: 10.3760/cma.j.issn.1008-5734.2017.05.020.
- Angadi S, Karn A. Ibuprofen induced Stevens-Johnson syndrome – toxic epidermal necrolysis in Nepal. *Asia Pac Allergy*. 2016;6(1):70-73. doi: 10.5415/apallergy.2016.6.1.70.
- Dobry AS, Himed S, Waters M, Kaffenberger BH. Scoring assessments in Stevens-Johnson syndrome and toxic epidermal necrolysis. *Front Med*. 2022;9:883121. doi: 10.3389/fmed.2022.883121.
- Torres-Navarro I, Briz-Redón Á, Botella-Estrada R. Accuracy of SCORTEN to predict the prognosis of Stevens-Johnson syndrome/toxic epidermal necrolysis: a systematic review and meta-analysis. *J Eur Acad Dermatol Venerol*. 2020;34(9):2066-2077. doi: 10.1111/jdv.16137.
- Chang HC, Wang TJ, Lin MH, Chen TJ. A review of the systemic treatment of Stevens-Johnson syndrome and toxic epidermal necrolysis. *Biomedicines*. 2022;10(9):2105. doi: 10.3390/biomedicines10092105.
- Noe MH, Micheletti RG. Systemic interventions for treatment of Stevens-Johnson syndrome/toxic epidermal necrolysis: summary of a Cochrane review. *JAMA Dermatol*. 2022;158(12):1436-7. doi: 10.1001/jamadermatol.2022.4543.
- Heuer R, Paulmann M, Mockenhaupt M, Nast A. Systemic immunomodulating therapies for epidermal necrolysis (Stevens-Johnson syndrome/toxic epidermal necrolysis): a systematic review and meta-analysis. *J Dtsch Dermatol Ges*. 2025;192(1):9-18. doi: 10.1111/ddg.15804.
- Hasegawa A, Abe R. Recent advances in managing and understanding Stevens-Johnson syndrome and toxic epidermal necrolysis. *F1000Res*. 2020;9:Faculty Rev-1014. doi: 10.12688/f1000research.24748.1.
- Schneider JA, Cohen PR. Stevens-Johnson syndrome and toxic epidermal necrolysis: a concise review with a comprehensive summary of therapeutic interventions emphasizing supportive measures. *Adv Ther*. 2017;34(6):1235-44. doi: 10.1007/s12325-017-0530-y.
- Martinez Villarreal JD, Cardenas-de la Garza JA, Ionescu MA, Tatu AL, Busila C, Mokni M, et al. Stevens-Johnson syndrome and toxic epidermal necrolysis: A review of current management

- and innovative therapies. *Int J Dermatol*. 2025;64(5):650-8. doi: 10.1111/ijd.17768.
24. Hsieh MH, Watanabe T, Aihara M. Recent dermatological treatments for Stevens-Johnson syndrome and toxic epidermal necrolysis in Japan. *Front Med*. 2021;8:636924. doi: 10.3389/fmed.2021.636924.
 25. Zimmermann S, Sekula P, Venhoff M, Motschall E, Knaus J, Schumacher M, Mockenhaupt M. Systemic immunomodulating therapies for Stevens-Johnson syndrome and toxic epidermal necrolysis: a systematic review and meta-analysis. *JAMA Dermatol*. 2017;153(6):514-522. doi: 10.1001/jamadermatol.2016.5668.
 26. Jacobsen A, Olabi B, Langley A, Beecker J, Mutter E, Shelley A, et al. Systemic interventions for treatment of Stevens-Johnson syndrome (SJS), toxic epidermal necrolysis (TEN), and SJS/TEN overlap syndrome. *Cochrane Database Syst Rev*. 2022;(3):CD015050. doi: 10.1002/14651858.CD013130.pub2.
 27. Hama N, Aoki S, Chen CB, Hasegawa A, Ogawa Y, Vocanson M, et al. Recent progress in Stevens-Johnson syndrome/toxic epidermal necrolysis: diagnostic criteria, pathogenesis and treatment. *Br J Dermatol*. 2025;192(1):9-18. doi: 10.1093/bjd/ljae321.
 28. Cao J, Zhang X, Xing X, Fan J. Biologic TNF- α inhibitors for Stevens-Johnson Syndrome, toxic epidermal necrolysis, and TEN-SJS overlap: A study-level and patient-level meta-analysis. *Dermatol Ther*. 2023;13(6):1305-1327. doi: 10.1007/s13555-023-00928-w.
 29. Bhandari M, Khullar G. Target and targetoid lesions in dermatology. *Indian J Dermatol Venereol Leprol*. 2022;88(3):430-434. doi: 10.25259/IJDVL_901_20.
 30. Pejčić AV. Stevens-Johnson syndrome and toxic epidermal necrolysis associated with the use of macrolide antibiotics: a review of published cases. *Int J Dermatol*. 2021;60(1):12-24. doi: 10.1111/ijd.15144.
 31. Tsai TY, Huang IH, Chao YC, Li H, Hsieh TS, Wang HH, et al. Treating toxic epidermal necrolysis with systemic immunomodulating therapies: a systematic review and network meta-analysis. *J Am Acad Dermatol*. 2021;84(2):390-397. doi: 10.1016/j.jaad.2020.08.122.