A Rare Manifestation of Bullous Systemic Lupus Erythematosus in Children: A 10-year Retrospective Study in a Tertiary Care Hospital

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1. Introduction

Bullous systemic lupus erythematosus (BSLE) is a rare cutaneous condition. This manifestation mainly occurs in adult female individuals [1], and is even less frequent in the pediatric population [2]. Diagnosis of BSLE is challenging since similarities in the histology and immunopathology exist between BSLE and other primary bullous dermatoses, such as dermatitis herpetiformis (DH), linear IgA bullous dermatosis, and epidermolysis bullosa acquisita (EBA) [3–5]. However, clinical presentation combined with histology, immunological testing, and concomitant diagnosis of SLE distinguish this entity from other similar dermatoses [6]. Because of its rarity, the majority of previous publications were case reports. A previous study revealed a total of 10 BSLE patients during a 12-year retrospective review in the Thai adult population [7]; however, the literature on pediatric BSLE is scarce. The objective of this study was to perform a 10-year retrospective review of the pediatric population diagnosed with BSLE in the present tertiary care setting.

2. Methods

2.1. Study Design. The authors conducted a cross-sectional epidemiological study (10-year retrospective study) from January 1st, 2012, to December 31st, 2021, by collecting data from the medical records and the Health Object Program®,
an authorized electronic medical records program, at the Srinagarind Hospital, Faculty of Medicine, Khon Kaen University, Thailand. All patients aged < 18 years who fulfilled the diagnostic criteria for BSLE, and who visited the Srinagarind Hospital, Faculty of Medicine, Khon Kaen University, were included in the study. Collected data included clinical characteristics, extracutaneous involvement, histopathologic features, immunofluorescence patterns, serological abnormalities, internal organ involvement, treatments, and outcomes.

The diagnostic criteria for BSLE that were used for the diagnosis in the present study were the revised diagnostic criteria initial proposed by Camisa and Sharma (1983) [8], which included (1) a diagnosis of SLE based upon American Rheumatism Association criteria, (2) vesicles or bullae developing upon but not limited to sun-exposed skin, (3) histopathologic features of the lesional skin compatible with subepidermal blisters containing predominantly a neutrophil infiltration, similar to that of DH or inflammatory EBA, (4) negative or positive IIF for circulating BMZ antibodies using the split-skin technique, and (5) DIF of the lesional or nonlesional skin reveals linear or granular deposits of IgG and/or IgM and often IgA at the BMZ in case of the linear pattern deposition.

The study was approved by the Institutional Review Board of Khon Kaen University, Human Research Ethics Committee (#HE651011). The patients’ informed consent forms and confirmation that all methods were performed in accordance with the relevant guidelines and regulations have been submitted to the journal.

2.2. Statistical Analysis. At the end of the study, the collected data were analysed using STATA software version 10 (StataCorp LP). Descriptive statistical methods, means, standard deviations (SDs), medians, and frequencies were used to analyse the demographic data.

3. Results

Among the 1,415 patients aged < 18 years diagnosed with SLE, six developed vesiculobullous lesions. Five patients were validated for the diagnosis of BSLE, accounting for 0.35%. One patient with a vesiculobullous lesion was diagnosed with chronic bullous dermatosis of childhood (CBDC). Among the five BSLE patients, four were female (80%) and one was male. The mean age at diagnosis was 12.2 years old (SD, 1.92). Three of five developed BSLE simultaneously with the diagnosis of SLE. Two patients developed BSLE after SLE onset, with a mean onset of 35 days (10 days and 2 months). All patients fulfilled the criteria for the diagnosis of SLE using the European Alliance of Associations for Rheumatology (EULAR) and American College of Rheumatology (ACR) classifications. Constitutional symptoms with significant weight reduction before diagnosis were observed in all patients. Hematologic abnormalities, serositis, and renal involvement were found in all patients. Polyarthritis (40%) and neurological abnormalities (40%) were less frequently observed. The clinical presentation and laboratory findings of patients with BSLE are described in Table 1.

The clinical manifestations of BSLE in the study population were generalized tense bullae, and some presented with large extensive vesicles on the lips, perioral, and mucosal areas (Figure 1). Figure 2 shows the histopathology of cutaneous lesions of BSLE in the study population which revealed subepidermal blisters with neutrophils and interface dermatitis. Vacular alterations at the dermoeipidermal interface with necrotic keratinocytes were also noted. We used direct immunofluorescence (DIF) to diagnose BSLE, but due to a technical issue with recording DIF photos, the authors were unable to produce DIF photographs of the presenting cases (a limitation of retrospective study design). Figure 2 shows immunohistochemical staining of a leftover specimen in one of the cases described. Immunohistochemical studies showed deposition of IgG at the dermoepidermal junction and within vessel walls and C3 deposits at the dermoeipidermal junction, with negative results for IgA and IgM. The other histopathological findings are described in Table 1.

Systemic corticosteroids, intravenous immunoglobulin (IVIG), immunosuppressants; mycophenolate mofetil, antimalarials, and dapsone were prescribed to treat BSLE in the study population. The cutaneous lesions subsided in all patients, with a median clearance duration of 14 days (range, 5–56 days). Long-term cutaneous hypopigmentation and discouragement of the involved areas were documented. Renal impairment was the remaining long-term consequence of pediatric BSLE which require aggressive immunosuppressant therapy and regular long-term follow-up.

4. Discussion

BSLE is a rare cutaneous manifestation of SLE, especially in the pediatric population [9]. The present study performed a retrospective study in a pediatric population and revealed five cases of BSLE, accounting for 0.35% of pediatric SLE cases during the past 10 years. This number was relatively high compared to the previous studies which were presented in case reports [1, 10–12]. This may be explained by the fact that the present study was performed in a referral center, dealing with severe and complicated pediatric SLE; thus, patients with uncommon or severe clinical presentations were transferred to this tertiary care center.

BSLE rarely presents as an initial or isolated manifestation [9, 13, 14]. This finding correlated with our setting, which revealed that none of the nondiagnosed SLE patients presented with isolated bullous lesions. Three of five (60%) patients exhibited BSLE simultaneously with the diagnosis of SLE and two of five (40%) developed BSLE later. The presentation of vesiculobullous lesions was found concurrently, or shortly after the diagnosis of SLE guided physicians to the final diagnosis of this rare condition [15]. However, bullous lesions in SLE should be distinguished from other bullous dermatoses [5], such as DH, EBA, CBDC, and leukocytoclastic vasculitis [16]. Therefore, BSLE should be confirmed by histology and immunopathology.
<table>
<thead>
<tr>
<th>Category</th>
<th>No. 1</th>
<th>No. 2</th>
<th>No. 3</th>
<th>No. 4</th>
<th>No. 5</th>
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</thead>
<tbody>
<tr>
<td>Age at diagnosis (years)</td>
<td>10</td>
<td>11</td>
<td>13</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Gender</td>
<td>F</td>
<td>M</td>
<td>F</td>
<td>F</td>
<td>F</td>
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<tr>
<td>Constitutional symptoms/weight loss</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

**Cutaneous lesion**

(i) Vesiculobullous pattern  
- Generalized tense bullae with varying sizes on the face, trunk, back, and extremities  
- Generalized tense bullae with varying sizes on the face, lips, trunk, back, and genitalia  
- Multiple tense bullae on the lips, perioral, and genital area  
- Multiple tense bullae on the lips, mucosa, and genital area  
- Large and multiple tense bullae on the lips and perioral area  

(ii) Oral ulcer  
- Yes  
- Yes  
- Yes  
- Yes  
- Yes  

(iii) Mucosal lesions  
- Yes  
- Yes  
- Yes  
- Yes  
- Yes  

(iv) Other cutaneous manifestation  
- No  
- Cutaneous vasculitis, palmar erythema  
- Malar rash  
- Discoid rash on the scalp with scarring alopecia  
- No  

**Histopathological tissue compatible with SLE**

(i) Skin  
- Yes  
- Yes  
- No  
- No  
- Yes  

(ii) Kidney  
- No  
- No  
- Yes  
- Yes  
- No  

(iii) Other tissue  
- No  
- No  
- Yes  
- Yes  
- No  

**Systemic involvement**

Neurological involvement  
- No  
- Yes (Seizure)  
- Yes (Seizure)  
- No  
- Yes  

Polyarthritis  
- No  
- No  
- Yes (pericardial effusion)  
- Yes  
- Yes  

Serositis  
- Yes (pleural effusion)  
- Yes (pleural effusion)  
- Yes (pleural and pericardial effusion)  
- Yes (pericardial effusion with cardiac tamponade)  
- Yes (pleural effusion)  

Hematological abnormalities  
- Yes  
- Yes  
- Yes  
- Yes  
- Yes  

(i) AIHA  
- Yes  
- Yes  
- Yes  
- Yes  
- Yes  

(ii) Lymphopenia  
- Yes  
- Yes  
- Yes  
- Yes  
- Yes  

(iii) Thrombocytopenia  
- No  
- Yes  
- Yes  
- Yes  
- Yes  

(iv) MAS/HLH  
- No  
- Yes  
- Positive  
- Positive  
- No  

(v) DCT  
- Negative  
- Positive  
- Positive  
- Positive  
- Positive  

Renal involvement  
- Yes  
- Yes  
- Yes (LN class IV)  
- Yes (LN class IV)  
- Yes (LN class IV)  

(i) Hypertension  
- Yes  
- Yes  
- Yes  
- Yes  
- Yes  

(ii) BUN/Creatinine  
- 72.7/2.73  
- 5.3/1.73  
- 33/1.4  
- 26.9/1.77  
- 23/1.07  

(iii) Proteinuria  
- Yes (protein 4+)  
- Yes (protein 1+)  
- Yes (protein 3+)  
- Yes (protein 2+)  
- Yes (protein 3+)  

(iv) Glomerulonephritis  
- Yes (RBC 10–20)  
- Yes (RBC 5–10)  
- Yes (RBC 20–30)  
- Yes (RBC 30–50)  
- Yes (RBC 10–20)  

(v) UP CR(mg/mg)  
- (Normal range <0.2)  
- 3  
- 5.7  
- 7.5  
- 3.7  
- 2  

**Complement levels**

(i) C3 (normal range 90–180)  
- Low (52.9)  
- Low (9.8)  
- Low (12.3)  
- Low (22)  
- Low (18)  

(ii) C4 (normal range 10–40)  
- Low (10.7)  
- Low (0.6)  
- Low (6)  
- Low (7)  
- Low (5)  

Vitamin D level (normal range >20)  
- Low (8.24)  
- Low (23)  
- Deficiency  
- N/A  
- N/A  

Serum albumin (g/dl)  
- 3.2  
- 2.1  
- 2.4  
- 3.3  
- 3.0  

**ANA**  
- Positive  
- Positive  
- Positive  
- Positive  
- Positive  

- Coarse speckle type  
- Coarse speckle type  
- Homogenous type  
- Homogenous type  
- Coarse speckle type  

- 1:2560  
- 1:2560  
- 1:1280  
- 1:5120  
- 1:2560
Some previous reports revealed that BSLE can be found even if the patient does not exhibit high SLE disease activity [14, 17]. This finding is in contrast to the present study which revealed high lupus disease activities with low complement levels in all patients (Table 1). The present study also revealed that multiple organ involvement was frequently found in patients with BSLE, especially hematologic abnormalities, serositis, and renal involvement, which were found in all of the study population. Serositis, including pleural and pericardial effusion, was extremely severe in this study.

Figure 1: Generalized tense bullae, and extensive vesicles on the lips, perioral, and mucosal areas in patients with bullous systemic lupus erythematosus.

### Table 1: Continued.

<table>
<thead>
<tr>
<th>Category</th>
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<tbody>
<tr>
<td>Anti-dsDNA</td>
<td>Positive 720 IU/ml</td>
<td>Positive 104.8 IU/ml</td>
<td>Positive</td>
<td>Positive</td>
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</tr>
<tr>
<td>Anti-smith</td>
<td>Positive 116 IU/ml</td>
<td>Negative</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td>Treatments</td>
<td>Dapsone</td>
<td>Dapsone</td>
<td>Prednisolone</td>
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<td></td>
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<td>HCQ</td>
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<td>HCQ</td>
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<tr>
<td>Outcomes</td>
<td></td>
<td></td>
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<tr>
<td>(i) Cutaneous clearance (days)</td>
<td>14</td>
<td>56</td>
<td>7</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>(ii) Long-term cutaneous lesions</td>
<td>Discolouration hypopigmentation on the involved area</td>
<td>Discolouration on the involved area</td>
<td>Hypopigmentation on the involved area</td>
<td>Complete recovery</td>
<td>Complete recovery</td>
</tr>
<tr>
<td>(iii) Renal impairment</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>LN</td>
<td>LN</td>
<td>LN</td>
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<tr>
<td>(iv) Hematological abnormalities</td>
<td>Improve</td>
<td>Improve</td>
<td>Recovery</td>
<td>Recovery</td>
<td>Recovery</td>
</tr>
</tbody>
</table>

AIHA, autoimmune induced hemolytic anemia; ANA, antinuclear antibody; Anti-dsDNA, anti-double stranded DNA; BUN, blood urea nitrogen; CP, cyclophosphamide; DCT, direct Coombs’ test; HCQ, hydroxychloroquine; HLH, hemophagocytic lymphohistiocytosis; IVIG, intravenous immunoglobulin; LN, lupus nephritis; MAS, macrophage activation syndrome; MMF, mycophenolate mofetil; N/A, not available; UPCR, urine protein/creatinine ratio.
population. Patients with renal involvement had lupus nephritis with active glomerulonephritis and required intensive and long-term immunosuppressants.

While systemic corticosteroids and immunosuppressants are the mainstay treatments for SLE, oral dapsone is frequently used in BSLE and it resolves cutaneous lesions [6, 12]. Several treatment modalities were prescribed in the study population due to the exhibition of high disease activity with severe multiple organ involvement. These include systemic corticosteroids, IVIG, immunosuppressants; mycophenolate mofetil, antimalarials, and dapsone. In recalcitrant cases of BSLE, rituximab was recently found to be an efficacious choice for patients who do not respond to dapsone or other immunosuppressants [6].

In a 12-year retrospective review, the majority of patients healed without scarring or milia, although postinflammatory hypo- or hyperpigmentation may be observed [7]. This finding is similar to the outcome of the present study which revealed complete clearance of the cutaneous lesion with a median duration of 14 days without BSLE recurrence. However, the remaining long-term consequence of pediatric BSLE in the study population was renal involvement which required aggressive immunosuppressant therapy and regular long-term follow-up.

5. Conclusions

In the present study, BSLE in the pediatric population had auxiliary manifestations that exhibited high disease activity. Multiple organ involvement, especially hematologic abnormalities, serositis, and renal involvement, were frequently found in the pediatric population. Although cutaneous lesions in BSLE subsided in all patients, the remaining long-term consequence of pediatric BSLE was renal involvement which required aggressive immunosuppressant therapy and regular long-term follow-up.
5.1. Limitation. The main limitation of the present study was its retrospective design, which resulted in a lack of certain information, such as pathological and immunofluorescent pictures. However, all available documents fulfilled the diagnostic criteria for BSLE, a rare presentation in the pediatric population.

**Abbreviations:**

SLE: Systemic lupus erythematosus  
BSLE: Bullous systemic lupus erythematosus  
CBDC: Chronic bullous dermatosis of childhood  
DH: Dermatitis herpetiformis  
EBA: Epidermolysis bullosa acquisita.

**Data Availability**

The data and materials used and/or analysed during the current study are available from the corresponding author on reasonable request.

**Ethical Approval**

The study was approved by the Institutional Review Board of Khon Kaen University, Human Research Ethics Committee (#HE651011).

**Conflicts of Interest**

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

**Authors’ Contributions**

All authors contributed to the study’s conception and design. Data collection and analysis were performed by SP, RU, and LT. The first draft of the manuscript was written by LT, and all authors commented on the subsequent versions of the manuscript. PU and CC provided the patients’ pathological pictures. All authors read and approved the final manuscript for the final submission.

**References**