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Epidemiological, Diagnostic, Therapeutic, and Outcome Profile of Pediatric Systemic Diseases in Chad

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Abstract

Background: Pediatric systemic diseases are heterogeneous, potentially disabling, and under-reported in Sub-Saharan Africa. We aimed to describe their epidemiological, diagnostic, therapeutic, and outcome profile in a hospital setting in Chad. **Methods:** We conducted a retrospective descriptive study with a prospective component in the Rheumatology Unit between January 2020 and September 2024. Cases were identified using standard clinical and paraclinical criteria (ACR/EULAR where applicable). Demographic, clinical, laboratory, treatment, and outcome data (CHAQ, JADAS when available) were analyzed with SPSS 21.0. **Results:** Among 5000 patients seen during the study period, 111 fulfilled criteria for pediatric-onset systemic diseases (frequency 2.34%): juvenile idiopathic arthritis (JIA) 85 (76.6%) and connective tissue diseases 26 (23.4%) including acute rheumatic fever 7, juvenile Sjögren's syndrome (primary/secondary) 15, dermatomyositis 2, systemic sclerosis 1, and systemic lupus erythematosus 1. Females accounted for 78/111 (70.3%). Mean age at disease onset was 11.21 years (range 2 - 16); mean diagnostic delay was 4.2 years (3 months - 32 years). JIA subtypes were: systemic 5 (including 1 MAS), RF-negative polyarticular 26, RF-positive polyarticular 14, oligoarticular 6, enthesitis-related arthritis 26, and undifferentiated 5. Acute anterior uveitis occurred in 13 cases. Management relied mainly on NSAIDs, corticosteroids, hydroxychloroquine, and methotrexate; biologics (etanercept) were used in 3 patients. Outcomes were generally favorable; three deaths were recorded (1 MAS, 1 infectious syndrome with dyspnea, 1 bedridden state). **Conclusions:** In this Chadian cohort, JIA predominated, whereas acute rheumatic fever was less frequent than

historically reported. Conventional DMARDs remain the mainstay of therapy; access to biologics is limited. Diagnostic delays and severe complications underscore the need for earlier recognition, systematic follow-up, and improved access to advanced therapies.

Subject Areas

Pediatrics

Keywords

Juvenile Idiopathic Arthritis, Pediatric Systemic Diseases, Acute Rheumatic Fever, Outcomes, Methotrexate, Sub-Saharan Africa, Chad

1. Introduction

Pediatric systemic diseases are a heterogeneous group of rare but potentially severe disorders that affect children and adolescents. These diseases include juvenile idiopathic arthritis (JIA), connective tissue diseases (CTDs) (such as juvenile Sjögren's syndrome, dermatomyositis, systemic lupus erythematosus), and acute rheumatic fever. They are characterized by complex clinical presentations, variable disease courses, and significant functional and psychosocial consequences if not diagnosed and treated early [1] [2].

In high-income countries, pediatric rheumatic diseases are increasingly well recognized thanks to the availability of pediatric rheumatology specialists, structured referral networks, and advanced diagnostic tools [3] [4]. In contrast, in many Sub-Saharan African countries, these diseases remain underdiagnosed and under-reported [5]. Several factors contribute to this situation, including limited awareness among primary care physicians, lack of specialized services, delayed referral, socioeconomic constraints, and restricted access to diagnostic and therapeutic resources, especially biologic agents [6] [7].

In Chad, pediatric systemic diseases represent a real but poorly documented clinical challenge. Previous studies on childhood rheumatic diseases in the region are scarce, often limited to case reports or small series, and mainly focused on acute rheumatic fever [8]-[10]. There is currently no comprehensive hospital-based study describing the overall profile of pediatric systemic diseases in Chad.

The objective of this study was therefore to describe the epidemiological, diagnostic, therapeutic, and outcome characteristics of pediatric systemic diseases managed in the Rheumatology Unit of the Refoundation Hospital Chad (HRT), Chad.

2. Patients and Methods

2.1. Study Design and Setting

We conducted a retrospective descriptive study with a prospective component between January 2020 and September 2024 in the Rheumatology Unit of the

Refoundation Hospital Chad (HRT). This is the main tertiary referral center for rheumatic diseases in the country, serving both urban and rural populations. The prospective component included 40 consecutively recruited patients between January 2023 and September 2024, with systematic evaluation using CHAQ and JADAS at baseline and last visit.

2.2. Study Population

We included all patients under 16 years of age who consulted for or were hospitalized with pediatric systemic diseases during the study period. Cases were identified from medical records, hospitalization registers, and consultation logs.

Patients were classified into two groups:

- Juvenile idiopathic arthritis (JIA) according to the International League of Associations for Rheumatology (ILAR) criteria [1];

- Pediatric connective tissue diseases, including juvenile Sjögren's syndrome [2], dermatomyositis, systemic lupus erythematosus (SLE), systemic sclerosis, and acute rheumatic fever (revised Jones criteria).

We excluded patients with incomplete medical records, uncertain diagnoses, or non-systemic musculoskeletal conditions (e.g., mechanical pain syndromes, isolated trauma).

2.3. Data Collection

A standardized data collection sheet was used to extract information from patient files. The following variables were collected:

- Demographic data: Age, sex, geographic origin (urban vs. rural);

- Clinical data: Disease type, onset date, major clinical manifestations, extra-articular features (including ocular involvement), diagnostic delay (time between symptom onset and diagnosis);

- Laboratory data: Inflammatory markers, autoantibodies (ANA, rheumatoid factor, anti-CCP), HLA-B27 status when available;

- Radiological data: Standard X-rays, ultrasound, and MRI when performed;

- Therapeutic data: Use of NSAIDs, corticosteroids, conventional DMARDs (methotrexate, hydroxychloroquine, sulfasalazine), and biologic agents;

- Outcome data: Functional status (CHAQ score), disease activity (JADAS score for JIA). Functional disability was assessed using the validated French version of the Childhood Health Assessment Questionnaire (CHAQ), and disease activity was evaluated using the Juvenile Arthritis Disease Activity Score (JADAS). Missing data were handled through complete-case analysis, without imputation.

Missing data were handled using a complete-case analysis without imputation, and the corresponding sample size (N) was specified for each analysis.

2.4. Statistical Analysis

Data were entered and analyzed using SPSS version 21.0. Qualitative variables were presented as frequencies and percentages. Quantitative variables were expressed

as means ± standard deviations (SD) or medians (interquartile range, IQR) as appropriate. Group comparisons were performed using the χ^2 test or Fisher's exact test for qualitative variables, and Student's t test or Mann-Whitney U test for quantitative variables. A p-value < 0.05 was considered statistically significant. Missing data were handled using a complete-case analysis without imputation, and the sample size (N) is specified for each analysis.

2.5. Ethical Considerations

This study was approved by the Institutional Ethics Committee of HRT (Approval No. 013/2023). Data were collected confidentially, and patient anonymity was strictly preserved. The study complied with the principles of the Declaration of Helsinki.

3. Results

3.1. General Characteristics of the Study Population

A total of 111 pediatric cases of systemic diseases were included out of 5000 patients seen during the study period, representing a hospital frequency of 2.34%. The mean age at disease onset was 11.2 ± 3.6 years (range: 2 - 16 years). Females predominated with 78 cases (70.3%), giving a female-to-male ratio of 2.4:1. The mean diagnostic delay was 4.2 years (range: 3 months - 32 years).

3.2. Disease Spectrum

Juvenile idiopathic arthritis (JIA) was the most frequent condition with 85 cases (76.6%). Connective tissue diseases (CTDs) accounted for 26 cases (23.4%), distributed as follows:

- Acute rheumatic fever: 7 cases;
- Juvenile Sjögren's syndrome (primary or secondary): 15 cases;
- Dermatomyositis: 2 cases;
- Systemic sclerosis: 1 case;
- Systemic lupus erythematosus: 1 case. See Table 1.

3.3. Juvenile Idiopathic Arthritis Subtypes

The distribution of JIA subtypes was as follows:

- Systemic JIA: 5 cases (including 1 case complicated by macrophage activation syndrome);
- RF-negative polyarticular JIA: 26 cases;
- RF-positive polyarticular JIA: 14 cases;
- Oligoarticular JIA: 6 cases;
- Enthesitis-related arthritis (ERA): 26 cases;
- Undifferentiated JIA: 5 cases.

Acute anterior uveitis was observed in 13 JIA patients (15.3%), mainly in ERA and oligoarticular subtypes. See Table 2.

Table 1. Distribution of patients according to systemic diseases.

Systemic diseases	Number of cases (N = 111)	Percentage (%)
Connectivites		
SGSS	20	18.0
SGSP	16	14.4
LES	12	10.8
Sharp syndrome	4	3.6
Scleroderma	2	1.8
Other connectivites	3	2.7
Vasculitis	4	3.6
Rheumatic fever	5	4.5
Mixed systemic diseases	45	40.5

Table 2. Distribution of patients according to rheumatologic manifestations.

Manifestations	Number of cases	Percentage (%)
Peripheral		
Monoarthritis	7	6.3
Oligoarthritis	18	16.2
Polyarthritis	60	54.1
Axial		
Cervical pain	8	7.2
Dorsal pain	6	5.4
Low back pain	7	6.3
Talalgia	3	2.7
Buttock pain	2	1.8

3.4. Paraclinical Findings

Inflammatory markers (ESR, CRP) were elevated in nearly all cases. Autoantibody testing was performed in 90% of patients.

- ANA positivity was found in 46 cases (41.4%);
- Rheumatoid factor was positive in 14 polyarticular JIA cases;
- Anti-CCP antibodies were detected in 9 cases;
- HLA-B27 was tested in 20 ERA patients, with 13 positives (65%).

Radiographic abnormalities were common, particularly joint space narrowing and erosions in polyarticular JIA. No MRI was performed due to limited availability. See Table 3.

3.5. Therapeutic Management

Treatment relied mainly on NSAIDs, corticosteroids, and conventional DMARDs

Table 3. Distribution of patients according to extra-rheumatologic manifestations.

Extra-rheumatologic manifestations	Number of cases	Percentage (%)
Cutaneous (onycholysis)	15	13.5
Ocular (uveitis)	12	10.8
Cardiac	6	5.4
Pulmonary	4	3.6
Renal	3	2.7
Digestive	2	1.8

(methotrexate, hydroxychloroquine, sulfasalazine). Methotrexate was prescribed in 82 cases (73.9%). Hydroxychloroquine was used in 22 patients (mostly CTD). Biologic therapy (etanercept) was available for only 3 patients, all with severe ERA. Physiotherapy and orthopedic management were systematically integrated when needed.

3.6. Outcomes and Complications

After a mean follow-up of 28 months (range 2 - 56), outcomes were favorable in the majority of patients. Three deaths were recorded:

- One due to macrophage activation syndrome;
- One due to severe infection with dyspnea;
- One in a bedridden patient with advanced disease.

Functional outcomes were evaluated with CHAQ in 70 patients:

- 45 (64.3%) had no or mild disability;
- 18 (25.7%) had moderate disability;
- 7 (10%) had severe disability.

In the prospective subset (N = 40), 62.5% of patients improved by at least one CHAQ category at the last visit, and 55% achieved low or inactive JADAS categories under conventional therapy. Because complete quantitative scores were unavailable for all patients, categorical rather than numerical comparisons were used.

Disease activity assessed by JADAS showed significant improvement under methotrexate and corticosteroids in most patients.

4. Discussion

This hospital-based study represents one of the largest pediatric rheumatology series ever reported from Chad. It provides a comprehensive overview of the epidemiological, diagnostic, therapeutic, and outcome profiles of pediatric systemic diseases in a low-resource, Sub-Saharan African setting.

The hospital frequency of pediatric systemic diseases in this study was 2.34%, similar to frequencies reported from other African hospital cohorts, which range between 1.5% and 3.5% [1] [2]. The female predominance observed (70.3%) aligns with most reports from both African and international series [3] [4]. The mean age of onset (11.2 years) is slightly higher than figures from Europe or North America,

where earlier detection of juvenile diseases is more common due to better healthcare access [5] [6].

The mean diagnostic delay of 4.2 years observed in this cohort can be explained by low awareness of pediatric rheumatic diseases among primary care physicians, geographical and financial barriers limiting access to specialized care, scarcity of advanced diagnostic tools, and sociocultural factors such as traditional medicine pathways delaying consultation. Similar delays have been reported in several Sub-Saharan African settings [6]-[9].

JIA was by far the most common diagnosis (76.6%), consistent with international trends identifying JIA as the leading cause of chronic inflammatory rheumatic disease in children [10]-[12]. However, the high proportion of enthesitis-related arthritis (ERA) and polyarticular forms is noteworthy. ERA accounted for 30.5% of JIA cases, a proportion much higher than typically observed in Western cohorts [12], but similar to figures reported in Senegal [13]-[18] and Cameroon [14]-[19]. This may be linked to HLA-B27 prevalence and genetic/environmental factors that remain poorly studied in Central Africa [20]-[23].

Connective tissue diseases (23.4%) were dominated by juvenile Sjögren's syndrome and acute rheumatic fever. The lower frequency of acute rheumatic fever compared to historical African series may reflect improved antibiotic access and primary prevention strategies [24] [25], but could also be due to underdiagnosis.

The moderate frequency of ANA positivity (41.4%) and HLA-B27 positivity (65% in ERA) is consistent with other African series [26] [27]. The limited use of MRI reflects infrastructural and financial constraints, common in low-resource settings.

Therapeutic strategies were largely based on NSAIDs, corticosteroids, and conventional DMARDs, particularly methotrexate. This pattern is typical of Sub-Saharan African pediatric cohorts [28] [29], where biologic therapies remain scarcely available due to their cost and logistical constraints. Only 3 patients received etanercept, which is far lower than in European centers, where biologics are widely used as second-line therapy for severe JIA [24]-[26] [30]. This therapeutic gap partly explains the persistence of functional disability in a subset of patients.

Despite these limitations, the overall short- to mid-term outcomes were favorable for most patients. The mortality rate was low but not negligible (2.7%), mainly due to severe complications such as macrophage activation syndrome and infections, as observed in other African cohorts [25] [26]. Functional outcomes were acceptable in two-thirds of patients, similar to results from Senegalese and Guinean series [13] [18]-[29]. However, the relatively high proportion of patients with moderate or severe disability reflects late diagnosis and limited therapeutic resources [31].

This study has some limitations. Its retrospective design may have introduced missing data and underestimation of rare conditions. It was conducted in a single tertiary hospital, which may not reflect the national epidemiological situation. Advanced diagnostic tests were not always available, particularly MRI and autoantibody panels. The lack of complete quantitative JADAS and CHAQ data, particularly in

the retrospective part of the cohort, limited the possibility of full numerical follow-up analysis. However, categorical improvement and disease activity endpoints remain consistent with those used in previously published African pediatric cohorts.

Nevertheless, this work provides valuable baseline data in a setting where pediatric rheumatology is still emerging.

This study highlights the urgent need to:

- Raise awareness among primary care physicians to reduce diagnostic delays;
- Strengthen training in pediatric rheumatology;
- Improve access to imaging and biologic therapies;
- Establish national registries for pediatric rheumatic diseases in Chad.

5. Conclusions

This study provides one of the first comprehensive overviews of pediatric systemic diseases in Chad. It highlights the predominance of juvenile idiopathic arthritis, the significant diagnostic delays, and the limited access to advanced diagnostic and therapeutic resources.

Despite these constraints, most patients achieved satisfactory short- to mid-term outcomes under conventional treatments such as NSAIDs, corticosteroids, and methotrexate. However, the persistence of functional disability in some patients underscores the need for earlier diagnosis and more effective long-term management strategies.

There is an urgent need to strengthen pediatric rheumatology services in Chad through improved early detection, enhanced physician training, better access to diagnostic tools, and expanded availability of biologic therapies. Establishing national registries and collaborative research networks would also contribute to a better understanding and management of these diseases in low-resource settings.

Ethical Approval

This study was approved by the Institutional Ethics Committee of the National Reference University Hospital (HRT), N'Djamena, Chad (Approval No. 013/2023). All procedures were conducted in accordance with the ethical standards of the committee and with the principles of the Declaration of Helsinki.

Authors' Contributions

Garba Harine Abdel Aziz: Conceptualization, data collection, analysis, manuscript drafting and supervision. Adama Bah: Methodology, data interpretation, and critical revision. Ramadhane Bouchrane: Data collection, clinical expertise, and revision. Sadou Yamoga Lam: Data acquisition and patient management. Rakseunbe Ignazianki: Statistical analysis and data verification. Hamid Harine Abdel Aziz: Manuscript review and editing. Moustapha Niasse: Critical review and scientific validation. Saïdou Diallo: Final approval of the manuscript and academic supervision.

All authors have read and approved the final version of the manuscript. All contributed significantly and agreed to be accountable for all aspects of the work.

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Conflicts of Interest

The authors declare no conflicts of interest.

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