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Extrapulmonary tuberculosis in Western Sudan during the armed conflict 2023-2024.

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Abstract

Background: Tuberculosis represents one of the foremost infectious cause of mortality globally; the disease is endemic in Sudan and has experienced a significant increase amid the ongoing armed conflict. This study aims to investigate extrapulmonary tuberculosis in Western Sudan during the conflict period from 2023 to 2024. **Methodology:** A descriptive retrospective study was conducted at El-Obeid Teaching Hospital in North Kordofan State, Sudan, from August 2023 to September 2024. This was conducted on 233 patients diagnosed with extrapulmonary tuberculosis from a total of 751 patients with tuberculous infections. The study collected all data related to the patients from the hospital records during the specified period from 15 April 2023 to 15 April 2024. A total coverage of all patients diagnosed with extrapulmonary tuberculosis within the designated time frame, irrespective of any inclusion or exclusion criteria. Results: The data revealed that 65% were males and 35% were females. The most prevalent age group is > 46, followed by < 18, 26-35, and 36-45, with incidence rates of 37%, 18%, 17%, and 13%, respectively. The majority of the patients (59%) lived in urban areas, while 41% in rural areas.63% of them were married, while 35% were single. Tuberculous lymphadenitis was the most prevalent type of extrapulmonary tuberculosis, followed by tuberculous pleuritis, abdominal TB, spinal TB, tuberculous pericarditis, and TB meningitis (39%, 28%, 14%, 12%, 5%, and 2%, respectively). Conclusion: Extrapulmonary tuberculosis is widespread in western Sudan, with tuberculous lymphadenitis and tuberculous pleuritis being the most common manifestations of the disease. This study indicates greater values than what was previously recorded in the world. In Western Sudan the disease primarily affects middle-aged males, with the majority of cases presented beyond the 2 months period. The near-collapsed economy, the inadequately equipped health system, and the detrimental effects of the armed conflict were the primary factors in the study's findings.

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Keywords:

Pulmonary tuberculosis, Extrapulmonary tuberculosis, Sudan, Tuberculous lymphadenitis, Tuberculous pleuritis

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Introduction:

Human tuberculosis (TB) infection can be traced back 7,000 years to the Stone Age. In 1882, the great German bacteriologist Robert Koch (1843-1910) discovered the pathogen mycobacterium tuberculosis (MTB), which causes the disease in humans. Despite improvements and technology in immunization and treatment, the illness remains a major public health concern on a regional and global scale. The World Health Organization (WHO) anticipated that there would be around 10.6 million new cases in 2021 (6 million adult men, 3.4 million adult females, and 1.2 million children) [1]. Another opportunistic environmental pathogen is non-tuberculous mycobacterium (NTM), which primarily affects immunosuppressed people, particularly organ transplant recipients and those on immunosuppressive therapy.20-30% of NTM infections began in extrapulmonary locations such as the skin, soft tissues, spine, joints, and lymphatic tissues. NTM can be isolated from body fluids such as urine, blood, or cerebrospinal fluid; however, when culture is negative, molecular testing and histopathology are valuable diagnostic techniques in the right clinical setting and epidemiological context [2]. Extrapulmonary tuberculosis (EPTB) accounted for up to 17% of cases (both newly diagnosed and recurrent) worldwide in 2020, with tuberculous lymphadenitis (TBLN) and tuberculous pleuritis (TBP) accounting for 50-55% of all EPTB cases. EPTB is given less importance in public health programs than pulmonary tuberculosis because it is not contagious, allowing many cases to go undiscovered [3]. Musculoskeletal tuberculosis is another tough condition, with non-specific characteristics that mimic many different diseases, making early identification difficult and causing many cases to be found later on. Imaging is important in the therapy of musculoskeletal tuberculosis because it guides care, confirms the diagnosis, and detects complications and responses to treatment protocols [4]. Tuberculosis is a major cause of infertility in locations where it is prevalent. As a result, TB screening and management, particularly of the genitourinary system, are critical prior to medical treatment using assisted reproductive technologies such as in vitro fertilization-embryo transfer (IVF-ET). Reactivation of the illness during pregnancy following IVF-ET offers substantial hazards for both mother and fetus [5]. The TB survivor is a patient who has completed the TB treatment regimens and is no longer infected with MBT; yet, the lungs rarely entirely heal immediately after treatment ends. Lung damage, both structural and functional, may last for months, years, or even the rest of a person's life and is referred to as post-TB lung disease (PTLD) [6]. Looking at Sudan's current position, the economy is on the verge of collapse, resources are short, the health system is ill-equipped to meet basic health needs, and Sudan still has a long way to go to reach the Sustainable Development Goals (SDGs). According to the WHO and Sudan Health Observatory at the Federal Ministry of Health, the leading communicable illnesses causing morbidity and mortality are malaria, tuberculosis, schistosomiasis, pneumonia, and diarrhea [7]. The purpose of this study was to investigate extrapulmonary tuberculosis in western Sudan during the 2023-2024 military conflict.

Materials and Methods:

A descriptive retrospective study was conducted at El-Obeid Teaching Hospital in North Kordofan State, Sudan, spanning from August 2024 to September 2024.The study collected all data related to patients diagnosed with extrapulmonary tuberculosis from the hospital records during the specified period from 15 April 2023 to 15 April 2024. We conducted a comprehensive study on 233

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patients diagnosed with extrapulmonary tuberculosis from a total cohort of 751 patients with tuberculous infections. The sample size encompassed all patients diagnosed with extrapulmonary tuberculosis within the designated time period, irrespective of any inclusion or exclusion criteria. A full revision of the medical records of the patients, that includes history, physical examinations as well as the investigations, which were done to the patients like a tuberculosis blood test, a skin test, chest and spine x-rays, and bacterial tests like sputum smear microscopy and nucleic acid amplification test. In certain instances, examinations of pleural, ascitic, and pericardial fluids were also conducted. Magnetic resonance imaging of the spine and brain was conducted for some patients.

Statistical analysis:

We compiled all patient data into a data sheet before entering it into the Chicago, USA-based Statistical Package for the Social Sciences (SPSS) version 24. We analyzed the data to obtain frequencies, percentages, and cross-tabulations.

Results:

We investigated 233 patients with extrapulmonary tuberculosis aged 1 to 81, with a mean age and a standard deviation of 40 ±10.35. The most common type of extrapulmonary tuberculosis was tuberculous lymphadenitis, followed by tuberculous pleuritis, abdomen, spinal, and meningitis. The rates of occurrence were 90/233 (39%), 60/233 (28%), 33/233 (14%), 29/233 (12%), 11/233 (5%), and 4/233 (2%), as shown in Figure 1.

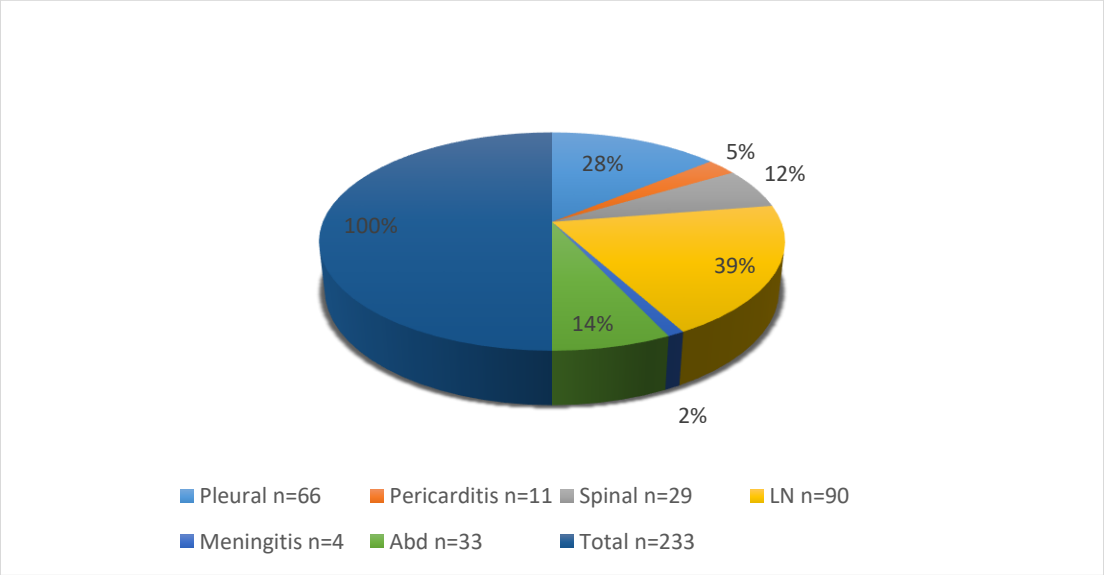

Figure 1 displays the many types of extrapulmonary tuberculosis.

151/233 (65%) were men, whereas 82/233 (35%) were women. Male gender predominates throughout all research populations, as shown in table 2 and figure 2. The majority of patients were older than 46 (37%), followed by those under 18 (18%), 26-35 (17%), 36-45 (15%), and 19-25 (13%). 137/233 (59% of the population) lived in cities, compared to 96/233 (41% in villages). Table 2 showed that, the bulk of the patients, 146/233 (63%) were married, 81/233 (35%) were single, and just 3/233 (1%) were divorced.

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Table 2 displays the distribution of the study's populations by gender, age, marital status, and place of residence.

Variable	Pleural n=66	Pericarditis n=11	Spinal n=29	LN n=90	Meningitis n=4	Abd n=33	Total n=233
Sex							
Male	49	10	16	48	4	24	151
Female	17	1	13	42	0	9	82
Total	66	11	29	90	4	33	233
Age							
≤ 18 years	5	1	2	32	0	3	43
19-25	9	2	1	13	0	5	30
26-35	11	3	3	17	2	3	39
36-45	11	3	3	8	0	10	35
≥46	30	2	20	20	2	12	86
Total	66	11	29	90	4	33	233
Marital Status							
Single	14	6	3	50	1	7	81
Married	51	5	22	40	3	25	146
Divorced	0	0	2	0	0	1	3
Widowed	1	0	2	0	0	0	3
Total	66	11	29	90	4	33	233
Residence							
Urban	34	2	20	63	1	17	137
Rural	32	9	9	27	3	16	96
Total	66	11	29	90	4	33	233

The predominant segment of the study populations comprised individuals who were unemployed, accounting for 27%. Workers made up 25% of the population, followed by students at 15%, gold mining workers at 13%, and farmers at 12%, as shown in Table 3. Table 3, clearly illustrate that the majority of patients had a primary level of education, followed by those who were illiterate and the secondary, intermediate, and university levels, with incidence rates of 35%, 31%, 22%, 6%, and 5%, respectively.

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Table 3 presents the distribution of the study populations categorized by their occupations and levels of education.

Variable	Pleural n=66	Pericarditis n=11	Spinal n=29	LN n=90	Meningitis n=4	Abd n=33	Total n=233
Occupation							
Employees	5	0	3	3	1	0	12
Farmers	10	2	5	6	1	3	27
Gold mining workers	14	4	2	4	1	4	29
Health workers	0	0	1	1	0	0	2
Jobless	18	1	8	28	0	9	64
Soldiers	1	1	0	4	0	1	7
Students	1	1	1	29	0	2	34
Workers	17	2	9	15	1	14	58
Total	66	11	29	90	4	33	233
Education							
Illiterate	20	6	11	25	2	8	72
Primary	21	3	3	39	0	15	81
Intermediate	5	0	2	5	0	2	14
Secondary	13	2	10	18	1	8	52
University	7	0	2	3	1	0	13
Postgraduate	0	0	1	0	0	0	1
Total	66	11	29	90	4	33	233

The majority of people with pleural illness 62/66 (94%) were new cases, whereas 4/66 (6%) were retreated patients. 25/66 (38%) presented within < 2 months, another 25/66 (38%) appeared during 2-6 months, 10/66 (15%) came within 6-12 months, and only 6/66 (9%) presented after 12 months. Of the patients with pericardial illness, 10/11 (91%) presented as new cases, and only one case 1/11 (9%) underwent retreatment. 7/11 (64%) experienced symptoms for less than 2 months, 3/11 (27%) within 2-6 months, and only one case 1/11(9%) for more than 12 months. In the spinal disease group, 25/29 (86%) were new cases, while the remaining 4/29 (14%) were retreated cases. About 13/29 (45%) had symptoms for more than 12 months; 10/29 (34%) for 2–6 months; and 6/29 (21%) for less than 2 months. In the lymphadenopathy group, 84/90 (93%) were new cases, 5/90 (6%) were retreated cases, and only one case, 1/90 (1%), was MDR. About 31/90 (34%) had symptoms for more than 12 months, 28/90 (31%) for less than 2 months, 21/90 (23%) for 2-6 months, and 10/90 (11%) for 6-12 months. All four cases of tuberculous meningitis were new, with 50% presenting within 2-6 months and 25% presenting within <2 months and 2-12 months, respectively. Of the patients with abdominal tuberculosis, 31/33 (94%) were new cases, and 2/33 (6%) underwent retreatment. Of the patients with abdominal tuberculosis, 11/33 (33%) experienced symptoms within 2-6 months, 8/33 (24%) within <2 months and >12 months, and 6/33 (18%) within 6-12 months. Table 4 clearly illustrate this.

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Table 4 shows the distribution of the study populations based on the length of symptoms and the type of TB case.

Variable	Pleural n=66	Pericarditis n=11	Spinal n=29	LN n=90	Meningitis n=4	Abd n=33	Total n=233
Durations of symptoms/month							
< 2month	25	7	5	28	1	8	74
2-6	25	3	5	21	2	11	67
6-12	10	0	6	10	1	6	33
> 12	6	1	13	31	0	8	59
Total	66	11	29	90	4	33	233
Type of TB case							
New case	62	10	25	84	4	31	216
Retreatment	4	1	4	5	0	2	16
MDR	0	0	0	1	0	0	1
Total	66	11	29	90	4	33	233

Discussion:

Tuberculosis is the world's leading infectious cause of death. The disease is endemic in Sudan and has a significant rise during the country's ongoing armed conflict [8]. In the current study, extrapulmonary tuberculosis was reported in 31% of the cases, which is higher than previous publications around the world, the WHO reported that EBTB represented 16% of the 7.1 million notified incident cases, ranging from 8% in the WHO Western pacific region to 24% in the Eastern Mediterranean region in 2019 [9]. However, reports from Algeria in 2021 showed that 18,825 new cases of tuberculosis were reported, with 29% of pulmonary origin and 71% of extrapulmonary origin, for an incidence of 42.4 per 100,000 population [10]. War is regarded as a major contributing factor to the spread of infectious diseases in general, particularly tuberculosis, because it destroyed the existing near-collapsed health system, disrupting prevention programs, destroying infrastructures, and deteriorating housing sanitation and hygiene [11].In the current study, tuberculous lymphadenitis (TBLN) and tuberculous pleuritis (TBP) were the most prevalent signs of extrapulmonary tuberculosis, accounting for 67%, with tuberculous lymphadenitis accounting for around 39%.93% of the cases of tuberculosis lymphadenitis were new, and the majority of them (68%) presented later than the two-month timeframe. In addition, 94% of the patients with tuberculous pleuritis were new cases; however, the majority of them (62%) presented late. In the world, tuberculous lymphadenitis is the most prevalent manifestation of extrapulmonary tuberculosis, accounting for around 35% of patients; cervical lymphadenopathy is the most common manifestation of TBLN, but inguinal, axillary, mesenteric, and mediastinal lymph nodes can be implicated [12]. Tuberculous pleuritis is the second most prevalent type of extrapulmonary tuberculosis. The major presentation is unilateral exudative effusion, which frequently appears with acute febrile illness, particularly in young immunocompetent patients. The most common symptoms are dyspnea, fever, cough, and chest pain. Other clinical symptoms include night sweats, weight loss, and malaise. The principal

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pathogenic mechanism is a delayed hypersensitivity reaction to mycobacterial antigen in the pleural space, which occurs less frequently than direct pleural infection [13].

The current study found that abdominal tuberculosis accounted for 14% of patients who presented with extrapulmonary tuberculosis, which is consistent with earlier studies around the world, where abdominal tuberculosis accounted for fewer than 3% of all TB cases [14] and approximately 12% of extrapulmonary TB [15]. However, some investigations show intestinal tuberculosis rates of 11-16% [16]. Intestinal tuberculosis has a less specific clinical presentation and remains a significant diagnostic issue, mimicking many other diseases such as Crohn's disease, abdominal lymphoma, and abdominal organ malignancy. The recent investigation indicated spinal TB in 4% of the cases. Approximately 8% of the cases of TB damaged the musculoskeletal system, with the spine accounting for 50% of these cases. Tuberculosis of the spine can affect both the vertebrae and the spinal cord. It can cause skeletal deformities such as knuckles, gibbus, kyphosis, and wedge fracture. Spinal cord tuberculosis can manifest as meningitis, myelitis, epidural and intradural abscesses, or spinal artery thrombosis [17].

In conclusion, in western Sudan, extrapulmonary tuberculosis is frequent and more prevalent than previously documented. Most affected individuals are middle-aged men, with the majority of them presented beyond the 2 months period. The contested, near-collapsed economy, ill-equipped health system, and damaging armed conflict shaped the study's findings.

Ethical Approval:

The Human Research Ethics Committee (HREC) at Prof. Medical Research Center-MRCC accepted the protocol of this investigation. Approval Number: HREC 0014/PMRCC.9/24.

Ethical consideration:

Approval was secured from the authorities at El-Obeid Teaching Hospital to access the requested information.

Availability of data and Materials:

Data pertaining to this study can be obtained from the corresponding author.

Conflicts of interest:

The authors report no conflicts of interest.

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Authors contribution:

Humida EHM: Conceptual, Study Design, Data analysis
Ibrahim SM: Conceptual, manuscript revision
Mohammed AKY: Conceptual, Study design, data search, revision, approval
Hamid NA: Conceptual, data collection, administration, manuscript revision
Ali AMO: Conceptual, data collection, administration, manuscript revision
Ahmed HG: Manuscript drafting, critical revision, consultation

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