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Original Article

Myelodysplastic Syndromes at Middle East and North Africa (MENA) Centers: Case Study Upper Egypt

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Abstract

Background: Research on Myelodysplastic Syndromes (MDS) is particularly sparse in the Middle East and North African (MENA) regions, with Upper Egypt representing a distinct area in terms of geography, climate, socio-demographics, and historical dualism of traditions and cultures. This study is the first to comprehensively assess the demographic, clinical, and hematologic characteristics of MDS in Upper Egypt, while also evaluating the disease's burden on patients.

Methods: Our study included 91 de novo MDS patients were recruited from Sohag university hospital, Assiut university hospital, Egypt during the period from June 2017 to January 2021. All patients subjected to history taking and clinical assessment, hematological, bone marrow analysis, iron studies and sideroblastic anemia, cytogenetic and molecular analysis and biochemical testing.

Results The mean age was 54.63 years, with female predominance (57.1%). Clinically, the most prevalent complaints were anemia (41.8%) and fever (24.2%). On examination, 72.5% presented with pallor, and 45.1% had purpura, while organomegaly varied with 41.8% having no organomegaly. The study identified MDS-MLD as the most common subtype (50.5%) and normocytic normochromic as the predominant anemia type (56%). In terms of treatment, 52.7% received supportive care, and the complete response rate was 2.2%. Correlation analysis showed age and ECOG performance status positively related to bone marrow blast percentage with r = 0.222 and r = 0.271 respectively, and overall survival had a moderate positive correlation (r = 0.502) with progression-free survival.

Conclusion: This study indicates that Myelodysplastic Syndromes predominantly affect middle-aged adults in Upper Egypt, predominantly females, with varied clinical presentations and a predominance of low-risk patients according to IPSS-R, suggesting a better prognosis. Normal cytogenetics were prevalent, and MDS-MLD was the most common classification.

Keywords: Myelodysplastic Syndromes (MDS), Upper Egypt, Middle East and North Africa (MENA)

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Introduction

Myelodysplastic syndromes (MDS) are a heterogeneous group of clonal hematopoietic stem cell disorders, primarily characterized by ineffective hematopoiesis leading to multilineage dysplasia and peripheral blood cytopenias. These conditions are known for their tendency to progress into acute myeloid leukemia (AML), with approximately 30% of cases evolving into this more aggressive form. [1]

In the early stages, MDS is marked by excessive programmed cell death (apoptosis), leading to a variable degree of cytopenia .[2]

The disease is driven by an accumulation of genetic and epigenetic lesions in immature progenitor cells, which result in abnormal terminal differentiation and increased blast accumulation.

This progression is further influenced by microenvironmental changes and immune dysregulation contributing to the differentiation defect. [3]

The incidence rate of MDS in the general population is approximately 4.5 per 100,000 people per year, with a higher incidence in males compared to females. The incidence increases markedly with age, typically presenting in individuals in their 60s or 70s .[4]

Historically, the diagnosis of MDS has relied on the morphological examination of peripheral blood smears, bone marrow (BM) aspirates, and BM trephine biopsies. However, the presence of hypocellular marrows or disease-related fibrosis, especially in the early stages of the disease, may complicate diagnosis .[5]

Several classification systems, including the French-American-British (FAB) system and the World Health Organization (WHO) classification, have been developed to categorize MDS and predict the transformation into AML. These systems are based on a variety of factors, including blast percentage, morphological features, and cytogenetic findings.[6, 7]

The revised International Prognostic Scoring System (IPSS-R) further refines prognosis predictions using additional markers such as bone marrow cytogenetics and peripheral blood cytopenia. [8]

The study aims to assess the overall response rate (ORR) and survival outcomes of MDS patients residing in Upper Egypt. The overarching objective is to provide a detailed description of MDS within MENA centers, using Upper Egypt as a case study.

Patients and methods

Between June 2017 and January 2021, a total of 91 de novo Myelodysplastic Syndromes (MDS) patients were systematically recruited from Sohag and Assiut University Hospitals, Egypt. Inclusion criteria were based on a diagnosis of MDS following the 2016 World Health Organization (WHO) diagnostic guidelines.[9]

Exclusion Criteria:

Patients were excluded from the study if they diagnosed by secondary Acute Myeloid Leukemia (AML) or prior treatment with granulocyte colony-stimulating factors or hypomethylating agents (Azacitidine/Decitabine).

Clinical and Laboratory Assessment:

Comprehensive history taking and clinical assessment were performed on all patients to evaluate symptoms and disease progression.

Hematological Analysis: Complete blood counts were obtained using the Cell-Dyn 3700 automated cell counter (Abbott Diagnostic, Dallas, USA). Special attention was given to degrees of cytopenias and reticulocyte count, crucial for MDS characterization.

Bone Marrow Analysis: Aspiration and biopsy were conducted on all patients to assess marrow cellularity and dysplasia. Dysplasia was considered significant if ≥10% of bone marrow (BM) nucleated cells from any lineage were dysplastic. Mild megaloblastic changes without other lineage dyspoiesis were not considered diagnostic of MDS.

Iron Studies and Sideroblastic Anemia: Perls' stain was utilized to identify increased iron stores and the presence of ring sideroblasts.

Cytogenetic and Molecular Analysis: Conventional karyotyping and Fluorescence In Situ Hybridization (FISH) targeting chromosomes 5, 7, 8, 11, and 13 were performed.

Biochemical Testing: Liver function tests, Lactate Dehydrogenase (LDH), serum creatinine, and Ferritin levels were measured using cobas C501 (Roche Ltd, Risch-Rotkreuz, Switzerland).

Treatment and Follow-Up:

All patients were initiated on treatment plans consisting of erythropoietin and supportive care, with or without transfusion. Accordingly, patients

were stratified into transfusion-dependent and transfusion-independent groups.

Statistical Methods: The data were analyzed employing the IBM Statistical Package for Social Sciences software (SPSS), 25th edition, from IBM, United States. The Kolmogorov-Smirnov Test was employed to evaluate the normal distribution of continuous data. The presentation of results involved expressing qualitative data as numbers and percentages, while quantitative data with parametric distribution were represented by mean, standard deviations, and ranges. Non-parametrically distributed quantitative data were presented as median with interquartile range (IQR).

Results

Our study included 91 Myelodysplastic Syndrome (MDS) patients from Upper Egypt, with a mean age of 54.63 years (SD=5.02), predominantly female (57.1%). The median overall survival (OS) was 38 months with a generally favorable median Eastern Cooperative Oncology Group (ECOG) score of 0 (Table 1).

Table (1): Distribution of studied patients regarding demographic data, OS and ECOG

	Cases (n=91)	
Age (years)	54.63 +5.02	
Gender		
Male	39	(42.9 %)
Female	52	(57.1 %)
Overall survival (OS) median (IQR)	38	(24-47)
ECOG median (IQR)	0	(0-1)

Anemia (41.8%) and fever (24.2%) were the most reported clinical manifestations. Examination revealed 72.5% with pallor and various degrees of organomegaly, with 41.8% of patients showing no organomegaly and others showing mild to moderate splenomegaly (22.0%) and hepatom-egaly (28.6%) (Table 2).

Table 2: Distribution of studied patients regarding clinical data

	Cases (n=91)	
Complaint		
Manifestations of anemia	38	41.8 %
Fever	22	24.2 %
Anemia and fever	18	19.8 %
Anemia and bleeding	13	14.3 %
Examination		
Pallor	66	72.5 %
Purpura	41	45.1 %
Fever	23	25.3 %
Organomegaly		
No	38	41.8 %
Mild splenomegaly only	9	9.9 %
Mild hepatomegaly only	16	17.6 %
Mild hepatosplenomegaly	9	9.9 %
Moderate HSM	10	11.0 %
Huge splenomegaly	7	7.7 %
Moderate splenomegaly	2	2.2 %
Comorbidity		
Diabetes	19	20.9 %
Hypertension	6	6.6 %
Rheumatic heart disease	2	2.2 %
Colon cancer	5	5.5 %
Portal hypertension	3	3.3 %
Hiatus hernia	1	1.1 %
Autoimmune Hemolytic Anemia	2	2.2 %
Calcular Cholecystitis	5	5.5 %
Chronic kidney disease	2	2.2 %
RBCs allo		
Yes	10	11.0 %
No	81	89.0 %
Autoimmune Hemolytic Anemia		
Yes	7	7.7 %
No	84	92.3 %

Laboratory results indicated mean total leukocyte count of 5.29 x 10^3/ul (SD=4.53), mean neutrophil count of 2.49 x 10^3/ul (SD=2.67), and mean hemoglobin of 6.45 gm/dl (SD=2.27). The mean platelet count was 171.72 x 10^3/ul (SD=199.63), and the mean reticulocyte count was 1.62% (SD=1.89) (Table 3).

Table (3): Distribution of studied patients regarding laboratory data

	Cases (n=91)
	Mean ± SD
Total leucocyte count	5.29 ±4.53
Neutrophils count x10^3/ul	2.49 ± 2.67
Hemoglobin gm/dl	6.45 ± 2.27
Platelets count x10^3/ul	171.72 ± 199.63
Reticulocyte count %	1.62 ± 1.89
Blasts %	1.43 ± 3.00
Mean corpuscular volume (MCV)	86.48 ±9.0115
Mean corpuscular hemoglobin concentration (MCHC)	31.39 ± 2.04
Positive HCV	11 (12.1 %)
Positive HBV	3 (3.3 %)

The most common MDS subtype was MDS-MLD (50.5%), and normocytic normochromic anemia was observed in 56% of cases. Bone marrow assessment showed 53.8% with hypercellular marrow and 60% with normal cytogenetics, while specific genetic abnormalities like 5-q deletion and -7 were present in 6.7% and 13.3% of cases, respectively (Table 4)

Table (4): Distribution of studied patients regarding hematological data and IPSS-R score

	Cases (n=91)	
Myelodysplastic syndromes (MDS) types (WHO subtypes)		
MDS-MLD	46	50.5 %
MDS-SLD	11	12.1 %
MDS-RS	2	2.2 %
MDS-EB1	10	11.0 %
MDS-EB2	11	12.1 %
MDS unclassifiable	4	4.4 %
MDS/MPN	7	7.7 %
Anemia type		
Normocytic normochromic	51	56 %
Normocytic hypochromic	13	14.3 %
Macrocytic normochromic	11	12.1 %
Microcytic hypochromic	15	16.5 %
Microcytic normochromic	1	1.1 %
Bone marrow cellularity		
Hypercellular	49	53.8 %
Hypocellular	26	28.6 %
Normocellular	12	13.2 %
Heterogenous cellularity	4	4.4 %
Bone marrow blast (mean ± SD)	11.42 ± 3.28	
Cytogenetics		
Normal	55	60 %
5-q deletion	6	6.7 %
-7	12	13.3 %
+8	6	6.7 %
others	12	13.3 %
Revised International Prognostic Scoring System (IPSS-R)		
Very low	13	14.3 %
low risk	49	53.8 %
Intermediate	26	28.6%
high risk	2	2.2%
Very high	1	1.1%

Treatment responses varied with 6.6% receiving decitabine and growth factors and 52.7% receiving supportive treatment. Complete response was achieved in 2.2% of patients, while 30.8% showed hematological improvement with neutrophilic response. Progression to acute myeloid leukemia was observed in 10% of patients, with a mean time to transformation of 16.51 months (SD=5.26). Side effects were prevalent, with 33% experiencing no side effects, while others developed conditions such as RBCs alloimmunization (9.9%) or gastritis (25.3%). The median progression-free survival was 13 months (IQR: 11-13), and the most common reasons for treatment interruption were irregular treatment (28.6%) and side effects (25.3%) (Table 5).

Table (5): Distribution of studied patients regarding received treatment

	Cases (n=91)	
Treatment protocol:		
Decitabine and Growth factors	6	6.6 %
Supportive treatment	48	52.7 %
Immunosuppressive therapy	28	30.8 %
Combined Immunosuppressive therapy and thrombopoietin mimetics	9	9.9 %
Treatment outcome		
Complete response	2	2.2 %
Partial response	1	1.1 %
Hematological Improvement Erythroid response	7	7.7 %
Hematological Improvement Neutrophilic response	28	30.8 %
Hematological Improvement Platelet response	2	2.2 %
Stable Disease	8	8.8 %
Failure	18	19.8 %
Bone Marrow complete response	10	11.0 %
Progression to Acute myeloid leukemia	10	11.0 %
Died	5	5.5 %
Treatment side effects		
No	30	33 %
RBCs alloimmunization	9	9.9 %
HCV infection	5	5.5 %
Uncontrolled diarrhea	9	9.9 %
Gastritis	23	25.3 %
DM	7	7.7 %
Renal impairment	5	5.5 %
Other	3	3.3 %
Treatment duration median (IQR) in Months	2 (1-3)	
Etiology of treatment interruption		
Irregular treatment	26	28.6 %
Side effects	23	25.3 %
Cost	8	8.8 %
Far health facility	14	15.4 %
Lack of response	5	5.5 %
Unavailable transfusion	12	13.2 %
According to physician's instruction	3	3.3 %
Progression free survival (month) median (IQR)	13 (11-13)	
Acute myeloid leukemia type (n=10)		
M1-2	1	10 %
M2	4	40 %
M4	3	30 %
M6	2	20 %
Time till transformation (month) Mean $\pm$ SD	16.51 $\pm$ 5.26	

Correlation analysis revealed significant relationships with bone marrow blast percentage, such as a weak positive correlation with age (r = .222, p = 0.034) and a moderate positive correlation with ECOG score (r = 0.271, p = 0.009). Overall survival showed a moderate positive correlation with progression-free survival (r = 0.502, p = 0.001) (Table 6).

Table (6): Correlations between various clinical and hematological parameters with bone marrow blast percentage and progression-free survival

		Bone marrow blast%	Progression free survival (month)
Age	r	.222	0.068
	P-value	**0.034***	0.519
Overall survival	r	-0.168	.502
	P-value	0.112	**0.001***
ECOG	r	.271	-0.146
	P-value	**0.009***	0.167
Total leucocyte count	r	0.072	-0.154
	P-value	0.496	0.145
Neutrophils x10^3/ul	r	-0.084	0.024
	P-value	0.428	0.821
Hemoglobin	r	.301**	0.149
	Sig. (2-tailed)	**0.004***	0.160
Platelets x10^3/ul	r	-.291-	0.040
	P-value	**0.005***	0.703
Reticulocyte (%)	r	.391	.214
	P-value	**0.001***	**0.042***
Blast %	r	.766	0.004
	P-value	**0.001***	0.969
MCV	r	0.177	0.155
	P-value	0.093	0.141
MCHC	r	-0.101	-0.171
	P-value	0.343	0.106
duration of treatment interruption	r	0.152	-0.125
	P-value	0.150	0.236

When correlating patient characteristics with cytogenetic responses, the study found that age, total leucocyte count (TLC), hemoglobin, and platelets x10^3/µl showed no significant correlations (Table 7)

Table (7): Correlations between patient characteristics and the cytogenetic *r,* **Spearman's rank correlation coefficient**

	Cytogenetic responses	
	r	**p value**
Age	0.117	0.677
Total leukocytic count	-0.322	0.242
Hemoglobin	-0.037	0.895
Platelet x10^3/ul	0.101	0.719

The Kaplan-Meier survival curves reveal differences in cumulative survival rates among Myelodysplastic Syndrome (MDS) patients based on their treatment regimens and the duration of treatment interruption. Decitabine and Growth Factors treatment shows the most stable survival, suggesting some tolerance to treatment interrupt-ion. Supportive Treatment shows a more significant decrease in survival with treatment interruption, highlighting the importance of continuous treatment. Immunosuppressive Therapy and IST combined with Thrombopoietin Mimetics both show declines in survival with interruptions, but the combination treatment declines more gradually (Figure 1).

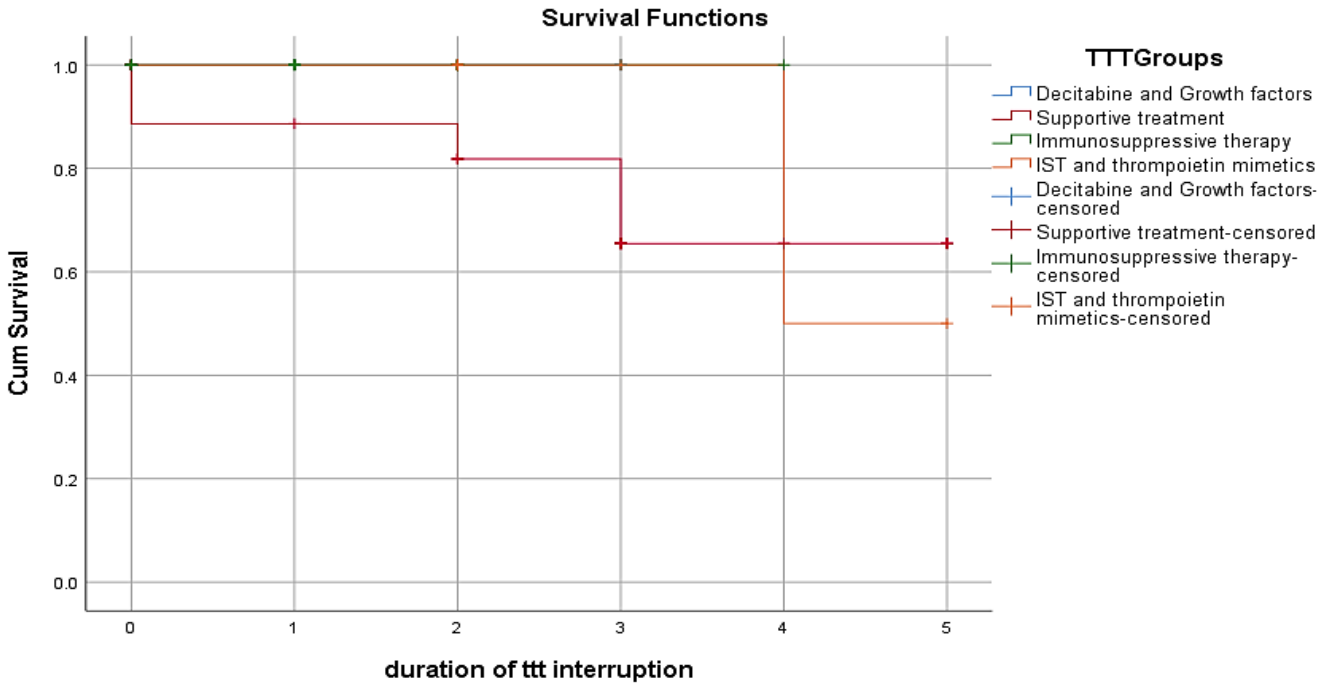

Figure 1: The Kaplan-Meier survival curves for duration treatment regimens

Discussion

Myelodysplastic syndromes (MDS) comprise a group of hematopoietic myeloid stem cell disorders, representing a hematologic malignancy that significantly impacts both the quality of life and survival of affected individuals .[10] Despite their clinical significance, MDS remains under-recognized, and the etiology of the condition is only elucidated in approximately 15% of cases. Notably, a subset of pediatric MDS cases, constituting one-third of patients, exhibits an inherited predisposition, with conditions such as Down syndrome, Fanconi anemia, and neurofibromatosis being implicated. Although less frequent in adults, the consideration of an inherited predisposition becomes paramount, especially in young adult patients or families with a history of MDS, acute myeloid leukemia (AML), or aplastic anemia [11]

The landscape of MDS management has undergone notable developments, with guidance largely influenced by the International Prognostic Scoring System (IPSS) and its revised iteration, IPSS-R. [12] These prognostic scoring systems play a crucial role in stratifying patients based on risk, thereby informing treatment decisions and prognostic assessments.

The present study contributes to the existing knowledge on MDS by focusing on 91 de novo MDS patients. These individuals were systematically recruited from two prominent medical institutions, Sohag University Hospital and Assiut University Hospital, located in Egypt. The recruitment spanned the period from June 2017 to January 2021, providing a comprehensive and contemporary dataset for analysis. By examining this cohort, the study aims to elucidate key demographic characteristics, clinical presentations, treatment patterns, and correlations within the context of MDS, thereby contributing valuable insights to the evolving landscape of MDS research and patient care.

Our study's findings shed light on various aspects of myelodysplastic syndromes (MDS), presenting a comprehensive snapshot of the demographic and clinical landscape. The mean age of 54.63 years suggests that MDS predominantly affects middle-aged adults, with a slight female predominance (57.1%). The median overall survival (OS) of 38 months and a median Eastern Cooperative Oncology Group (ECOG) score of 0 at baseline illustrate a general survival outlook and functional status of the cohort.

Clinically, patients commonly reported anemia and fever, with 41.8% and 24.2% respectively, reflecting the symptomatic burden of MDS. Physical examinations highlighted pallor in a majority of patients (72.5%) and varying degrees of organomegaly, indicating the diverse manifestations of the disease. Comorbidities such as diabetes (44.2%) and hypertension underline the importance of a holistic approach to managing

these patients, considering the added complexity of multiple health conditions.

Laboratory findings provide a quantitative view into the disease's impact with mean counts for leukocytes, neutrophils, and platelets, among others. These values, along with the mean corpuscular volume (MCV) and mean corpuscular hemoglobin concentration (MCHC), offer a window into the hematological disruptions caused by MDS. The study's breakdown of MDS types and anemia profiles, with MDS-MLD being the most common type and normocytic normochromic anemia the most prevalent form, further categorizes the patient population into subgroups for more targeted understanding and treatment approaches.

Bone marrow examination and cytogenetic analysis are crucial for understanding the prognosis and guiding treatment, with 60% of patients having normal cytogenetics and a mean bone marrow blast percentage of 11.42%. This highlights the biological diversity of MDS and its implications on patient outcomes.

Treatment outcomes varied significantly, with a small fraction achieving complete or partial response, emphasizing the challenging nature of treating MDS. Correlational analysis between various clinical and hematological parameters with bone marrow blast percentage and progression-free survival provided insightful associations. Notably, age and ECOG performance status show positive correlations with bone marrow blast percentage, while overall survival has a moderate positive correlation with progression-free survival, suggesting that longer overall survival is associated with delayed disease progression.

The Kaplan-Meier survival curves further delineate the impact of different treatment regimens on patient survival, with notable differences based on the type and duration of treatment interruption. These curves highlight the critical importance of consistent treatment and the potential benefits of certain therapies, such as Decitabine and Growth Factors.

In this study, we observed a higher mean age of 54.63 years for patients diagnosed with myelodysplastic syndromes (MDS), compared to previous studies conducted by **Ma et al** [13]. who reported a median age of 71 years at diagnosis. This difference in age could be attributed to various factors. One possible explanation is that the onset of MDS may be associated with co-morbidities that contribute to accelerated aging or inflammatory states conducive to the pathological events that lead to MDS. Another possibility is that patients with MDS may harbor occult germ-line variants with low penetrance that have yet to be described, thereby provoking somatic variants characteristic of classic MDS. [14]

In terms of gender distribution, our study found a female predominance of 57.1% compared to **Ma et al**. [13, 15] who reported a higher incidence or predominance of MDS in males. The female predominance observed in our study could potentially be explained by the higher incidence of del (5q) abnormalities, which are known to be more common in females .[16]

When considering comorbidities, we found that diabetes mellitus (DM) was the most common comorbidity among MDS patients in our study, with a low presentation of other illnesses. It is worth noting that comorbidities and socioeconomic status have been identified as significant and independent predictors of MDS survival .[15]

Regarding complete blood count (CBC) parameters, our findings showed that hemoglobin levels below 6 g/dL were observed, which is consistent with the findings of **AlMozain et al** [17] who suggested that anemia with a hemoglobin level below 90 g/dL is the most reliable indicator for making the diagnosis of MDS. Additionally, we observed that normocytic normochromic anemia was the most predominant type of anemia in our study, while other reports have indicated an increased mean corpuscular volume and erythrocyte distribution width or the presence of a dimorphic red blood cell population. [18]

In terms of platelet count, we found a mean count of 171.72 $\pm$ 199.63, which is considered low. Many studies have identified low platelet count as an independent prognostic factor and have included it in prognostic classification systems. [19, 20]

When analyzing bone marrow cellularity, we identified 49 cases (53.8%) with hypercellularity, 26 cases (28.6%) with hypocellularity, and 12 cases (13.2%) with normocellularity. These findings align with the results reported by **Maschek et al.** [21] and **Schemenau et al**. [22], who also observed similar proportions of hypercellular and hypocellular cases. These results highlight the

necessity of histopathology studies to aid in the diagnosis, monitoring, and therapy of MDS, especially in cases of refractory cytopenia with a normocellular or hypercellular bone marrow. [23]

In terms of risk stratification using the International Prognostic Scoring System-Revised (IPSS-R), we found that the majority of patients (53.8%) were categorized as low risk, while 28.6% fell into the intermediate risk group. These findings are favorable as they indicate better prognosis and overall survival .[24]

In our study, the most common cytogenetic pattern observed was normal (60% of patients), which is consistent with the findings reported by **ElNahass et al**. [25] who also found a similar proportion of patients with normal cytogenetics. The presence of peripheral blood cytopenia often raises concerns for MDS and related disorders, necessitating subclassifications for accurate diagnosis, monitoring, and therapy .[23]

The most common classification of MDS observed in our study was MDS with multilineage dysplasia (MDS-MLD), accounting for 50.5% of cases. This finding aligns with the results reported by **Paridar et al**. [26], who also identified MDS-MLD as the most common type. However, **Chauby et al.** reported MDS with single lineage dysplasia (MDS-SLD) as the most common type of MDS in India .[27] This discrepancy may be attributed to differences in ethnicity.

The IPSS categories were utilized in our study to plan therapeutic options, as they provide risk-based patient evaluation. [19] For lower-risk patients, therapy is aimed at achieving hematological improvement, while for higher-risk patients, the focus is on limiting disease progression and improving survival. Therapeutic options for higher-risk patients may include allogeneic hematopoietic stem cell transplantation, high-intensity therapy, low-dose chemotherapy, or hypomethylating agents.

Our study has some limitations. Firstly, the study's regional focus on Upper Egypt means the findings may not be generalizable to other regions or populations within the MENA region or globally. The specific environmental, genetic, and lifestyle factors prevalent in Upper Egypt might influence the disease presentation and progression, limiting broader applicability. Secondly, the sample size of 91 patients, while informative, is relatively small, which may affect the statistical power and robustness of the conclusions drawn. Thirdly, the study might not have captured all the socio-economic and healthcare access factors that could significantly impact the diagnosis, treatment, and outcomes of MDS in the region. Finally, the study might not include the latest advancements in MDS treatment and diagnosis, which could influence the applicability of the findings over time.

Conclusion

The study concludes that MDS affects a middle-aged adult population in Upper Egypt, with a slight female predominance and a varied range of clinical presentations and comorbidities. In addition, IPSS-R risk stratification revealed a majority of low-risk patients, indicating better prognosis and overall survival. Normal cytogenetics were prevalent, and MDS-MLD was the most common subtype. The survival rates, treatment responses, and hematological features detailed in the study offer a valuable baseline for understanding MDS in this region. The correlations between various clinical parameters and patient outcomes provide a foundation for further research and understanding of the disease's progression and treatment response in the context of Upper Egypt. Larger, multicentric studies should be conducted to validate and expand upon these findings, incorporating a more diverse patient population across different regions within the MENA area.

List of Abbreviations

(Arranged alphabetically)

Abbreviation	Meaning
ECOG	Eastern Cooperative Oncology Group
IPSS-R	Revised International Prognostic Scoring System
IST	Immunosuppressive Therapy
MDS-EB1	Myelodysplastic Syndrome- Excess Blast 1
MDS-EB2	Myelodysplastic Syndrome- Excess Blast 2
MDS-MLD	Myelodysplastic Syndrome Multilineage Dysplasia
MDS/MPN	Myelodysplastic Syndrome/ Myeloproliferative Neoplasm
MDS-RS	Myelodysplastic Syndrome- Ringed Sideroblast
MDS-SLD	Myelodysplastic Syndrome- Single Lineage Dysplasia
MENA	Middle East and North African Regions
ORR	Overall Response Rate
OS	Overall Survival

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