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A retrospective analysis of the clinico-epidemiological features and treatment outcomes of renal cell carcinoma at the Clinical Oncology Department at Ain Shams University in Egypt

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Abstract

Background: Renal cell carcinoma (RCC) is a biologically heterogeneous malignancy with variable clinical behaviour and survival outcomes. Real-world data from low- and middle-income countries remain limited, particularly regarding stage-specific treatment patterns and survival outcomes.

Methods: This retrospective cohort study included adult patients diagnosed with RCC and treated at the Clinical Oncology Department, Ain Shams University Hospitals, between January 2018 and December 2023. Patients were analysed as two pre-specified cohorts: (1) localised disease (Stage I–III) undergoing curative-intent surgery (n = 45) and (2) metastatic disease (Stage IV) receiving systemic therapy (n = 34). Survival outcomes were analysed using the Kaplan–Meier (KM) method and reported as medians with inter-quartile ranges (IQRs).

Results: A total of 79 patients were included (50 male, 63.3%; median age 57 years, IQR 50–66). In the localised cohort (n = 45), 43 underwent curative-intent surgery; disease recurrence occurred in 17 (39.5%). The 12-month disease-free survival (DFS) was 78.2%, and the 36-month DFS was 64.1%; median DFS was not reached within the observation period. In the metastatic cohort (n = 34), sunitinib was the predominant first-line agent; the KM estimated median progression-free survival (PFS) on sunitinib was 16 months (IQR 6–36), with a 6-month PFS rate of 75.4% and a 12-month PFS rate of 58.0%. The KM estimated median overall survival (OS) for Stage IV patients was 43 months from diagnosis. Disease recurrence and progression were significantly associated with inferior OS (p = 0.003 and p = 0.01, respectively).

Conclusion: Surgical resection remains the cornerstone of curative management. In the metastatic setting, sunitinib provided meaningful and durable disease control (median PFS 16 months; KM median OS 43 months) despite restricted immunotherapy access. High-risk pathological features identified in 33% of the localised cohort highlight an unmet need for adjuvant immunotherapy in resource-limited settings.

Keywords: *renal cell carcinoma, nephrectomy, sunitinib, targeted therapy, survival, Kaplan–Meier, retrospective, LMIC*

Research

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Introduction

Renal cell carcinoma (RCC) accounts for approximately 80%–85% of primary renal malignancies and represents a significant global health burden. It is the seventh most common cancer in men and the tenth in women worldwide, with clear cell RCC as the predominant histological subtype [1–3, 11, 16]. Although survival outcomes have improved due to advances in surgical techniques and systemic therapies, RCC continues to pose major challenges in advanced and metastatic stages [1, 2, 18].

In recent years, immune checkpoint inhibitor combinations have transformed the first-line treatment landscape for metastatic RCC. Despite these advances, access to novel agents remains severely limited in many low- and middle-income countries (LMICs), where sunitinib continues to represent the backbone of systemic treatment. This study aimed to retrospectively analyse the clinicoepidemiological characteristics, treatment strategies, and survival outcomes of patients with RCC treated at a tertiary oncology centre in Egypt, with separate analyses of the curative-intent surgery cohort and the metastatic/systemic therapy cohort [5–7].

Patients and methods

Study design and setting

This retrospective cohort study was conducted at the Clinical Oncology Department, Ain Shams University Hospitals, Cairo, Egypt, and included adult patients diagnosed with RCC managed between January 2018 and December 2023.

Study population

Eligible patients were identified through medical record review. Inclusion criteria comprised patients aged ≥18 years with histopathologically confirmed RCC. Two pre-specified analytical cohorts were defined: (1) Localised disease cohort - Stage I–III with curative-intent surgery (n = 45); (2) Metastatic/systemic therapy cohort - Stage IV disease (n = 34) [7–9].

Outcome measures and statistical analysis

The primary outcomes were disease-free survival (DFS) (time from curative surgery to first recurrence), progression-free survival (PFS) (time from initiation of systemic therapy to documented progression or last follow-up, with non-progressing patients censored), and overall survival (OS) (time from diagnosis to death or last follow-up). Survival outcomes were analysed using the Kaplan–Meier (KM) method with 95% confidence intervals (Greenwood method). For PFS analysis, all sunitinib-treated patients were included; patients without documented progression were treated as right-censored observations. All continuous variables are reported as median interquartile ranges (IQR). Group comparisons used the Mann–Whitney U test or log-rank test. A p-value ≤0.05 was considered statistically significant [11, 12].

Ethical considerations

This study was conducted after obtaining approval from the Research Ethics Committee, Faculty of Medicine, Ain Shams University. All patient data were anonymised prior to analysis.

Results

Patient demographics (n = 79)

A total of 79 patients with histopathologically confirmed RCC were included. The cohort comprised 50 males (63.3%) and 29 females (36.7%). The median age at diagnosis was 57 years (IQR 50–66; range 24–84). At presentation, 34 patients (43.0%) had Stage IV metastatic

disease; 15 (19.0%) had Stage III, 19 (24.1%) had Stage II and 9 (11.4%) had Stage I. Clear cell RCC was the predominant histological subtype (*n* = 50, 63.3%). At last follow-up, 56 patients (70.9%) were alive, and 23 (29.1%) had died (Table 1).

All OS values are KM estimates from the date of diagnosis and correctly account for censored observations (patients alive at last follow-up). KM median OS for the metastatic cohort = 43 months, consistent with Figure 1. The sunitinib median PFS of 16 months (Table 2) is measured from the start of treatment, not from diagnosis, and therefore is not directly comparable with the OS values in this table.

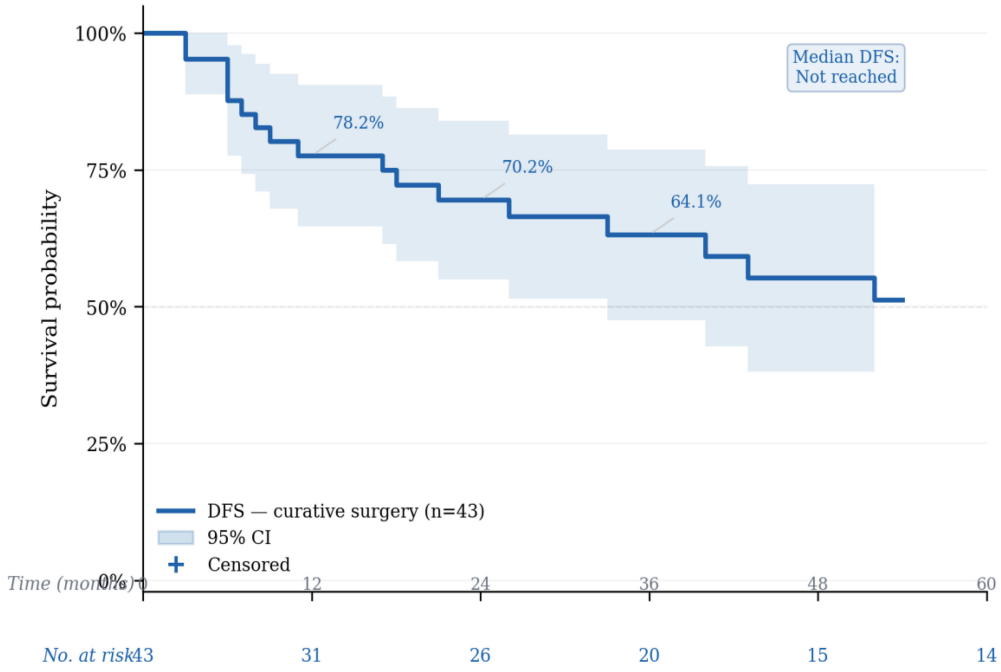

Figure 1. OS stratified by disease stage at diagnosis. KM curves with 95% CI; localised *n* = 45 (blue), metastatic *n* = 34 (red). KM median OS: localised NR; metastatic 43 months.

Table 1. Baseline patient characteristics.

Characteristic	Full cohort (*n* = 79)	Localised (*n* = 45)	Metastatic (*n* = 34)
Male sex, *n* (%)	50 (63.3%)	—	—
Median age, years (IQR)	57 (50–66)	60 (49–66)	56 (51–63)
Stage I / II / III / IV	9/19/15/34	9/19/15/—	—/—/—/34
Clear cell RCC, *n* (%)	50 (63.3%)*	30 (66.7%)	20 (58.8%)
Died at last follow-up, *n* (%)	23 (29.1%)	11 (24.4%)	12 (35.3%)
KM median OS from diagnosis†	NR (localised) / 43 mo (metastatic)	NR (not reached)	43 months†

* Other subtypes: papillary 12 (15.2%), chromophobe 5 (6.3%), mixed/other 5 (6.3%), unknown 7 (8.9%)

† Kaplan–Meier (KM) estimated median overall survival (OS) from date of diagnosis, correctly accounting for censored observations (patients alive at last follow-up). The sunitinib median progression-free survival (PFS) of 16 months (Table 2) is measured from the start of sunitinib treatment, not from diagnosis, and is therefore not directly comparable with the OS values in this table

Localised disease cohort: curative surgery (n = 45)

Of 45 patients with Stage I–III disease, 43 underwent surgery: radical nephrectomy *n* = 39 (90.7%), partial nephrectomy *n* = 3 (7.0%), simple nephrectomy *n* = 1 (2.3%). Two patients declined surgery. High-risk pathological features were present in a substantial proportion: pT3–T4 disease 15 (33.3%), perinephric fat invasion 9 (20.0%), pathological N1 5 (11.1%), nuclear grade 3–4 10 (22.2%), sarcomatoid differentiation 4 (8.9%) and lymphovascular invasion 5 (11.1%) [4, 14, 17, 23].

Disease-free survival

Disease recurrence occurred in 17 of 43 surgical patients (39.5%). The KM estimated DFS rates were as follows: 78.2% at 12 months, 70.2% at 24 months and 64.1% at 36 months (Figure 2). Median DFS was not reached within the observation period. Among relapsed patients, the median time to relapse was 11 months (IQR 6–26). No Stage I patient experienced recurrence. Disease recurrence was significantly associated with inferior OS (36-month OS: 58.0% versus 87.0%; $p = 0.003$; Figure 3). Lower baseline haemoglobin was significantly associated with recurrence (median 9.0 versus 12.0 g/dL; $p = 0.04$) [20, 27].

Table 2. Systemic therapy by line and agent.

Agent	Line	*n* treated	Events / *n*	Median PFS (months)
Sunitinib	1st	38	21 / 38	16 (IQR 6–36)
Pazopanib	1st	5	4 / 5	4 (*n* = 4; exploratory)
2nd-line (all agents)	2nd	17	9 / 17	4 (IQR 3–5)

Events/*n* = number of progression events / total at-risk. PFS measured from date of treatment initiation. All Kaplan–Meier estimates

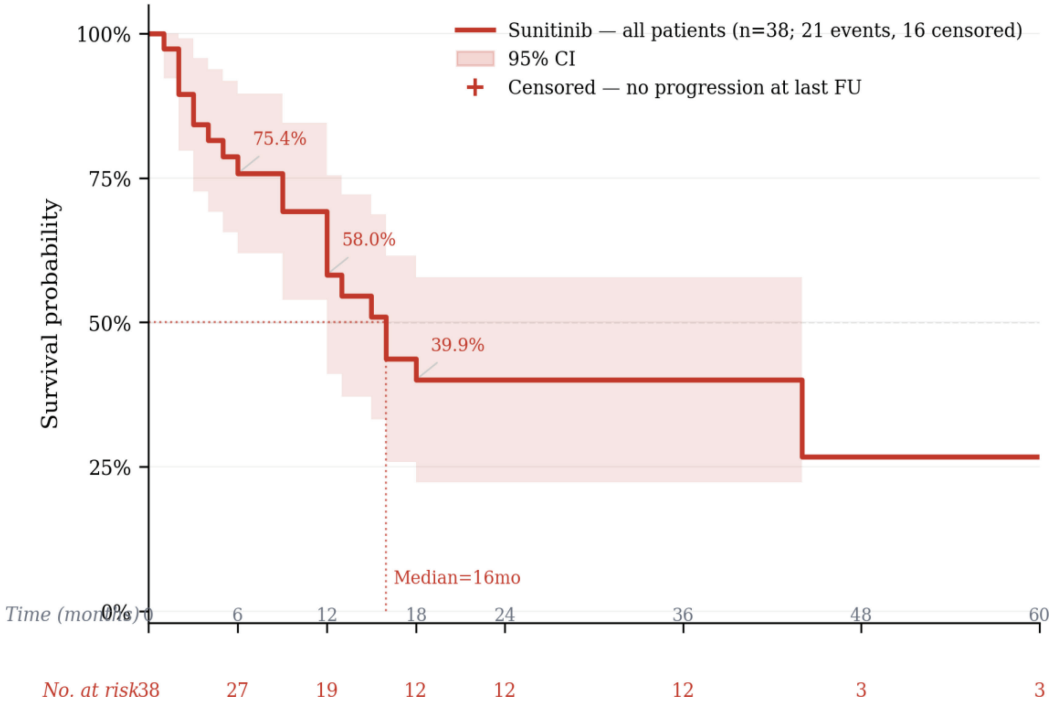

Figure 2. DFS after curative-intent surgery. KM KM curve, *n* = 43 surgical patients, 17 relapse events. Tick marks = censored; 95% CI as shaded band.

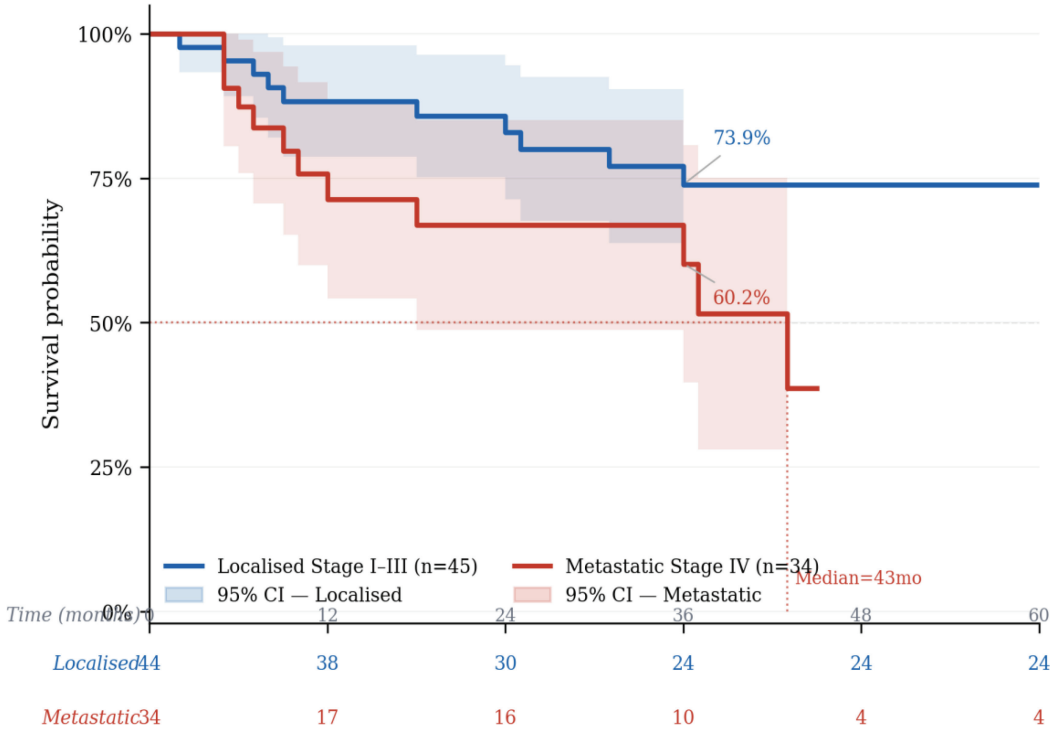

Figure 3. OS by disease recurrence status (surgical cohort). No recurrence *n* = 26 (teal) versus recurrence *n* = 17 (red). *p* = 0.003, log-rank test.

Metastatic/systemic therapy cohort (n = 34 at presentation)

Of 34 patients with Stage IV disease, 24 (70.6%) underwent cytoreductive nephrectomy (haematuria *n* = 5, loin pain *n* = 7, obstruction/other *n* = 5, selected favourable-risk *n* = 3). Cytoreductive surgery was performed for palliation within a multidisciplinary framework, not as routine survival-prolonging intervention, in line with CARMENA trial evidence [6].

First-line systemic therapy and PFS

Sunitinib was administered to 38 patients. KM analysis of PFS included all 38 patients (37 with follow-up time data), with 16 non-progressors treated as right-censored observations. The KM estimated median PFS was 16 months (IQR 6–36), with a 6-month PFS rate of 75.4% and a 12-month PFS rate of 58.0% (Figure 4). Pazopanib was administered to five patients (median PFS 4 months; *n* = 4 with events) [29, 30].

Second-line systemic therapy

In the second-line setting, 17 patients received further systemic therapy (pazopanib *n* = 12, everolimus *n* = 4, nivolumab *n* = 1). The median second-line PFS was 4 months (IQR 3–5; *n* = 9 with events) [31].

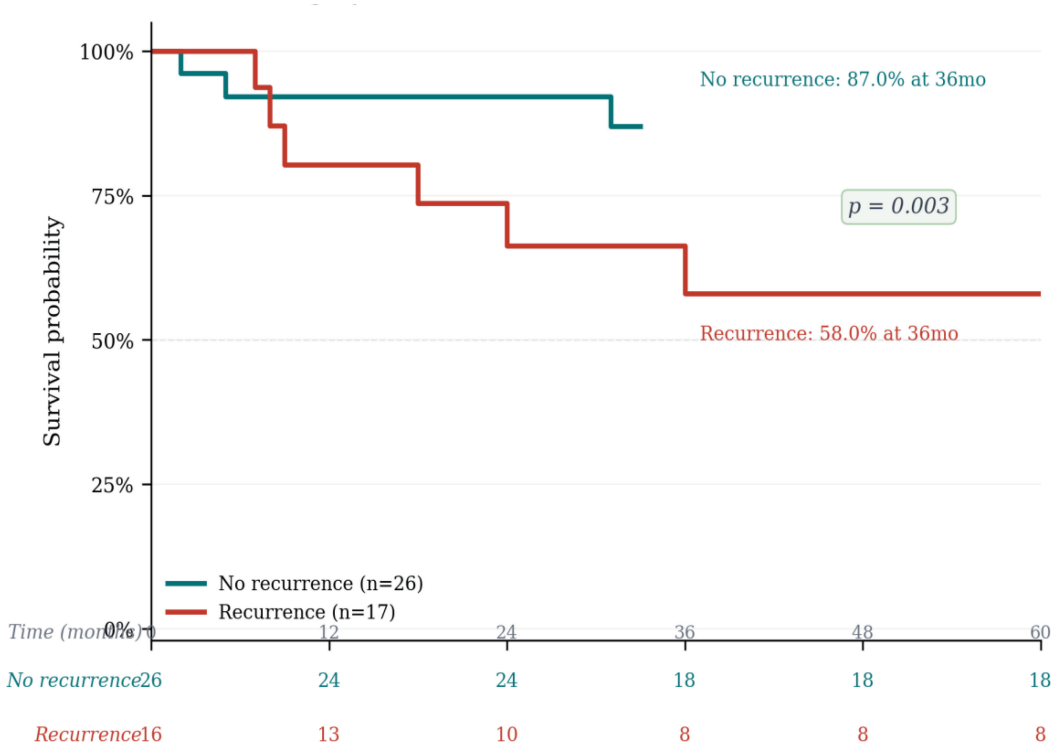

Figure 4. PFS on first-line sunitinib. All 38 treated patients (37 with follow-up data): 21 progression events, 16 censored (tick marks). Median PFS = 16 months. 95% CI as shaded band. PFS measured from start of sunitinib.

Overall survival

At last follow-up, 56 patients (70.9%) were alive, and 23 (29.1%) had died. The KM estimated median OS was not reached in the localised cohort within the observation period (36-month OS rate 73.9%; Figure 1). The KM estimated median OS for the metastatic cohort was 43 months from diagnosis (36-month OS rate 60.2%; Figure 1). Disease recurrence was significantly associated with inferior OS (36-month OS: 58.0% with recurrence versus 87.0% without; $p = 0.003$; Figure 3). Disease progression was similarly associated with inferior OS ($p = 0.01$) [21].

Discussion

This retrospective study provides real-world data on clinicoepidemiological characteristics, treatment patterns, and survival outcomes of 79 patients with RCC treated at a tertiary oncology centre in Egypt, presented within a structured two-cohort framework [12, 13].

The demographic profile is consistent with internationally published data, with a male predominance (63.3%) and a median age of 57 years (IQR 50–66). A substantial proportion (43.0%) presented with metastatic disease, reflecting delayed diagnosis characteristic of LMIC settings [12, 13, 21].

Surgical management served fundamentally different roles in the two cohorts. In the localised cohort, curative-intent nephrectomy represents the standard of care. The apparent survival advantage of surgical patients in aggregate analyses reflects stage-driven confounding

rather than a direct surgical survival effect. In the metastatic cohort, 24 of 34 patients underwent cytoreductive nephrectomy for symptom palliation, within a multidisciplinary framework and in line with CARMENA trial guidance [19],which recommends against routine upfront cytoreductive surgery [6, 18].

Disease recurrence and progression were the dominant determinants of OS. Patients who relapsed had a 36-month OS of 58.0% compared with 87.0% in those who remained disease-free (p = 0.003). A substantial proportion of localised patients harboured high-risk pathological features: pT3–T4 disease (33.3%), perinephric fat invasion (20.0%), pathological N1 (11.1%), nuclear grade 3–4 (22.2%), sarcomatoid differentiation (8.9%) and lymphovascular invasion (11.1%). The KEYNOTE-564 trial [20] demonstrated that adjuvant pembrolizumab significantly improved DFS in such high-risk patients (HR 0.68; p = 0.002), with confirmed OS benefit (HR 0.62). None of our patients received adjuvant therapy due to access constraints [5, 21, 23–26].

When all 38 sunitinib-treated patients are included in the KM analysis with correct censoring of non-progressors, the median PFS was 16 months (IQR 6–36), with 75.4% of patients progression-free at 6 months and 58.0% at 12 months. The KM median OS for Stage IV patients was 43 months from diagnosis. These figures are consistent with one another: OS is measured from diagnosis and includes any pre-treatment interval, while PFS is measured from the start of sunitinib and reflects time on active therapy. The 43-month KM OS is longer than the 16-month PFS because it accounts for time after progression in patients who received subsequent therapy, and because KM correctly weights the substantial proportion of patients still alive at last follow-up. The limited use of immunotherapy reflects financial and access barriers rather than clinical preference [29–31].

The magnitude of survival improvement achievable with contemporary immunotherapy-based combinations is substantial. Four landmark trials have transformed the first-line landscape: CheckMate 214 (nivolumab + ipilimumab; OS HR 0.68), KEYNOTE-426 (pembrolizumab + axitinib; OS HR 0.53), CheckMate 9ER (nivolumab + cabozantinib; OS HR 0.60), and CLEAR (lenvatinib + pembrolizumab; PFS HR 0.39). Achieving equitable access to these regimens in LMICs requires differential pricing policies and national formulary inclusion [1, 5].

Study strengths and limitations

The strengths include real-world design, two-cohort analytical framework, comprehensive KM survival analysis with correct censoring and 95% confidence intervals. Limitations include the retrospective single-centre design, relatively small sample size, underpowered recurrence subgroup (n = 17) and absence of adjuvant immunotherapy and first-line immunotherapy access, limiting comparison with contemporary cohorts [27].

Conclusion

RCC demonstrated markedly different outcomes between the localised and metastatic cohorts in this Egyptian real-world series. Surgical resection remains the cornerstone of curative management. When analysed with correct KM methodology, sunitinib provided a median PFS of 16 months and the metastatic cohort achieved a KM median OS of 43 months from diagnosis, reflecting meaningful disease control in this resource-constrained setting. A substantial proportion of localised patients harboured high-risk features for whom adjuvant pembrolizumab is now guideline-recommended but inaccessible. Closing the immunotherapy equity gap in LMICs requires both policy intervention and advocacy.

Conflicts of interest

The authors declare no conflicts of interest.

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Ethical approval

This study was conducted after obtaining approval from the Research Ethics Committee, Faculty of Medicine, Ain Shams University, Cairo, Egypt. All patient data were anonymised prior to analysis.

Data availability

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request.

Author contributions

Zizit Hamdi Mohammed El-shahawi: Study conception and design, data collection, analysis, manuscript drafting. Soheir Sayed Ismail: Study supervision, critical revision. Nesreen Ahmed Mosalam: Data interpretation, manuscript revision. Lamia Moustafa Ahmed: Data interpretation, manuscript revision. All authors approved the final manuscript.

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