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Original Research Article

Impact of Diabetes and Chronic Kidney Disease on Active Surveillance Outcomes for Small Renal Masses: A Cohort Study

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Abstract:

Objective: To evaluate the impact of diabetes and chronic kidney disease (CKD) on outcomes of active surveillance (AS) in patients with small renal masses (SRMs), focusing on tumor progression, renal function decline, and the need for delayed intervention.

Methods: A cohort of 55 patients with SRMs was observed from 2022 to 2024, with groups categorized by diabetes, CKD, both, or neither. Baseline demographic, clinical, and tumor data were collected. Tumor progression, renal function, and intervention rates were compared across groups using survival analysis and statistical tests.

Results: Tumor progression occurred in 32.7% of the cohort, with higher rates in patients with diabetes and/or CKD (approximately 40%) than in those without (10%). Patients with diabetes or CKD showed a shorter mean time to progression and a higher need for delayed intervention (25.5% overall). Renal function declined significantly more in patients with comorbidities, with eGFR reductions of over 10 mL/min/1.73 m².

Conclusion: Diabetes and CKD significantly impact AS outcomes, with increased tumor progression, faster renal function decline, and a greater likelihood of delayed intervention. Tailored AS protocols for patients with these comorbidities may improve patient outcomes.

Keywords: small renal masses, active surveillance, diabetes, chronic kidney disease

Introduction

Small renal masses (SRMs), generally defined as renal tumors less than 4 cm in diameter, are often detected incidentally due to the widespread use of imaging [1]. Active surveillance (AS) is increasingly utilized as a management strategy for SRMs, particularly for patients with comorbidities that increase the risks associated with surgical intervention [2,3]. AS allows for the monitoring of tumor progression over time, reducing immediate exposure to the potential complications of surgery. However, the effectiveness of AS may vary based on the patient's health profile, especially in individuals with underlying chronic conditions [4,5].

Diabetes and chronic kidney disease (CKD) are prevalent conditions that have well-documented impacts on overall health outcomes. Both are associated with systemic effects that could potentially influence the progression of renal masses and complicate management decisions. For patients with SRMs, the presence of diabetes or CKD might alter the growth dynamics of these tumors, as well as the patients' suitability for eventual surgical intervention, should the tumor progress [6,7].

This cohort study aims to evaluate the impact of diabetes and CKD on the outcomes of AS in patients with SRMs. By examining the progression rates, survival outcomes, and the need for delayed intervention, this research seeks to provide valuable insights that could guide personalized management strategies for individuals with SRMs and comorbid conditions. The findings may help refine AS protocols, ensuring they are tailored to improve patient outcomes while considering the unique risks posed by diabetes and CKD.

Methodology

Study Design and Setting:

This cohort study was conducted between 2022 and 2024 to assess the impact of diabetes and chronic kidney disease (CKD) on the outcomes of active surveillance (AS) for patients with small renal masses (SRMs). The study was performed in a single institution with standardized AS protocols

and included a multidisciplinary team for patient evaluation and follow-up.

Study Population: A total of 55 patients diagnosed with SRMs were enrolled in the study. Eligible patients included those with a small renal mass (≤4 cm) identified on imaging who had elected for AS as their initial management strategy. Patients were included if they had a confirmed diagnosis of diabetes, CKD, or both, allowing for assessment of the impact of these comorbidities on AS outcomes. Patients with advanced renal tumors, other malignancies, or those who required immediate intervention were excluded from the study.

Data Collection: Baseline demographic, clinical, and laboratory data were collected from all participants at the time of enrollment. This included information on age, gender, comorbid conditions, body mass index (BMI), blood pressure, diabetes status (including duration, medication type, and glycemic control levels), and CKD stage. Tumor characteristics, such as size, location, and initial growth rate, were documented based on radiologic imaging. Renal function was assessed using serum creatinine levels and estimated glomerular filtration rate (eGFR), classifying CKD stages per the Kidney Disease Improving Global Outcomes (KDIGO) guidelines.

Study Variables: The primary outcomes were tumor progression, defined as an increase in tumor size of ≥0.5 cm or changes in radiologic characteristics indicating malignancy potential, and overall survival. Secondary outcomes included renal function decline (based on eGFR changes) and the need for delayed intervention (surgery or ablation).

Follow-Up Protocol: Patients were followed at regular intervals, with imaging and renal function assessment every 6 months. Any significant changes in tumor size, radiologic appearance, or renal function prompted further evaluation. AS was continued as long as tumor growth was within acceptable limits and patient health remained stable.

Statistical Analysis: Data were analyzed to determine the relationship between diabetes, CKD, and AS outcomes. Descriptive statistics summarized baseline characteristics, while survival analysis methods, such as Kaplan-Meier curves, evaluated overall and progression-free survival. Cox proportional hazards regression was used to assess the impact of diabetes and CKD on the likelihood of tumor progression and delayed intervention.

Results

This cohort study followed 55 patients with small renal masses (SRMs) under active surveillance (AS) from 2022 to 2024, focusing on the impact of diabetes and chronic kidney disease (CKD) on tumor progression, renal function, and the need for delayed intervention.

Table 1: Demographic and Clinical Characteristics

Characteristic	Total (n=55)	Diabetes (n=20)	CKD (n=15)	Diabetes + CKD (n=10)	No Diabetes or CKD (n=10)
Age (mean ± SD, years)	64.3 ± 8.2	63.8 ± 7.5	66.5 ± 8.9	65.0 ± 8.1	62.9 ± 8.0
Male, n (%)	30 (54.5)	11 (55.0)	9 (60.0)	6 (60.0)	4 (40.0)
Mean BMI (kg/m²)	27.8 ± 4.5	28.2 ± 4.1	27.3 ± 4.6	28.0 ± 4.7	27.5 ± 4.5
Baseline eGFR (mL/min/1.73 m²)	55.6 ± 12.8	58.0 ± 11.5	42.5 ± 9.8	41.2 ± 8.7	61.4 ± 10.2
Tumor size (cm)	2.7 ± 0.9	2.6 ± 0.8	2.8 ± 0.7	2.9 ± 0.6	2.6 ± 1.0

The baseline characteristics of the study population show an average age of 64.3 years, with a slightly higher proportion of males (54.5%). Those with CKD, either alone or with diabetes, demonstrated lower baseline renal function as indicated by a lower eGFR. Tumor size at diagnosis was relatively similar across groups.

Table 2: Tumor Progression and Intervention Outcomes

Outcome	Total (n=55)	Diabetes (n=20)	CKD (n=15)	Diabetes + CKD (n=10)	No Diabetes or CKD (n=10)
Tumor Progression, n (%)	18 (32.7)	8 (40.0)	5 (33.3)	4 (40.0)	1 (10.0)
Mean Progression Time (months)	12.4 ± 4.7	11.9 ± 4.8	12.0 ± 4.2	11.5 ± 4.3	15.0 ± 4.5
Delayed Intervention, n (%)	14 (25.5)	6 (30.0)	4 (26.7)	3 (30.0)	1 (10.0)
Mean Time to Intervention (months)	13.8 ± 5.0	13.1 ± 4.7	12.7 ± 4.6	13.2 ± 5.1	16.0 ± 4.9

Tumor progression was observed in 32.7% of patients overall, with higher progression rates in patients with diabetes or CKD (around 40%) compared to those without either condition (10%). The mean time to progression

was shorter in patients with diabetes or CKD. A delayed intervention was required in 25.5% of the total cohort, with similar trends indicating a higher need for intervention among those with diabetes or CKD.

Table 3: Renal Function Decline

Renal Function Outcome	Total (n=55)	Diabetes (n=20)	CKD (n=15)	Diabetes + CKD (n=10)	No Diabetes or CKD (n=10)
Decline in eGFR >15%, n (%)	20 (36.4)	8 (40.0)	6 (40.0)	5 (50.0)	1 (10.0)
Mean eGFR Decline (mL/min/1.73 m²)	10.5 ± 3.6	10.8 ± 3.4	11.2 ± 3.5	12.0 ± 3.7	5.2 ± 3.1

Renal function decline, as indicated by a decrease in eGFR greater than 15%, was more prevalent in patients with diabetes and/or CKD, occurring in approximately 40-50% of these groups. Patients without these conditions had a notably lower decline in eGFR, with an average reduction of only 5.2 mL/min/1.73 m² compared to those with comorbidities. The presence of diabetes and CKD was associated with a higher rate of tumor progression, a shorter time to progression, and a greater likelihood of needing delayed intervention. Additionally, these comorbidities were linked to a more significant decline in renal function over the AS period, highlighting the need for personalized surveillance strategies in these patients.

Discussion

This cohort study investigated the impact of diabetes and chronic kidney disease (CKD) on active surveillance (AS) outcomes for patients with small renal masses (SRMs). Our findings indicate that patients with diabetes, CKD, or both experienced higher rates of tumor progression, an increased likelihood of requiring delayed intervention, and a more significant decline in renal function over time. These results align with previous studies that have shown adverse health outcomes in patients with chronic conditions like diabetes and CKD, which can impact renal tumor biology and patient management strategies [8,9].

The observed 32.7% progression rate in our study cohort is consistent with literature reports of progression rates between 30-40% in AS patients with comorbidities [10]. Notably, patients with either diabetes or CKD had a progression rate of approximately 40%, with a shorter time to progression than those without these conditions. These findings are similar to results reported by Nguyen et al. [11], who identified diabetes as a risk factor for accelerated SRM progression. The systemic inflammation and vascular changes commonly observed in diabetic patients could explain the increased growth rates of renal masses, supporting a closer monitoring approach in AS [12].

Renal function decline was notably more pronounced in patients with diabetes and CKD, with an average eGFR decline of more than 10 mL/min/1.73 m² over the study period. This decline is higher than that reported in studies of AS in patients without such comorbidities, such as the study by Campbell et al. [13], which reported average eGFR declines of around 5 mL/min/1.73 m² in patients without diabetes or CKD. This difference emphasizes the compounded impact of diabetes and CKD on renal health, suggesting that these patients may require tailored AS protocols that incorporate renal function preservation strategies.

The need for delayed intervention was also higher in patients with diabetes and/or CKD, similar to results from studies suggesting that comorbidities increase the risk of AS failure [14]. Delayed intervention was needed in 25.5% of our cohort, which is consistent with a recent study by Correa et al. [15], who reported similar intervention rates. Their findings, along with our study results, support that comorbidities like diabetes and CKD may alter the natural history of SRMs under AS, warranting more frequent evaluations and early intervention when indicated.

Future studies should involve a larger cohort and longer follow-up periods to provide more comprehensive insights into the long-term impact of diabetes and CKD on AS outcomes. Additionally, incorporating biomarkers of renal function and tumor progression could enhance our understanding of the underlying mechanisms and help identify patients at high risk of progression. Multicentre studies across diverse populations would further validate these findings, allowing for the development of standardized AS guidelines specific to patients with diabetes and CKD.

Conclusion

This study highlights the significant impact of diabetes and CKD on AS outcomes for patients with SRMs, emphasizing that these comorbidities increase the risk of tumor progression, renal function decline, and delayed intervention. These findings suggest that AS protocols should be adapted to account for patient-specific health factors, particularly in those with chronic conditions affecting renal health. Personalized AS strategies that consider the unique risks associated with diabetes and CKD may improve patient

outcomes, guiding the future management of SRMs in this vulnerable population.

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