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Case Series

Management of Small Renal Masses: A Case Series of Three Metastatic Cases from the Northern Territory

Jake Carmody*, Eliza Pridham, Sheshang Kamath

Top End Health Service, Northern Territory, Australia

***Corresponding Author:** Jake Carmody, Top End Health Service, Northern Territory, 105 Rocklands Dr, Tiwi NT 0810, Australia

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Abstract

Small Renal Masses (SRMs) ≤4 cm typically demonstrate limited metastatic potential and indolent growth patterns. We present three exceptional cases from Royal Darwin Hospital (2024-2025) that challenge conventional SRM risk stratification. All three SRMs presented with synchronous bone-only metastases at diagnosis, contradicting typical size-based risk predictions. Despite variable histologic features, each case demonstrated aggressive behaviour with widespread osseous involvement. The exclusive bone tropism across different histologic subtypes suggests potential common oncogenic pathways warranting investigation. These cases highlight significant exceptions to established paradigms, emphasizing that thorough staging and individualized risk assessment remain essential for all renal masses regardless of size.

Keywords: Oncology; Renal; Small Renal Mass; Urology

Introduction

Small Renal Masses (SRMs) are defined as solid enhancing renal tumours ≤4 cm in diameter, corresponding to clinical stage T1a in the TNM classification system [1]. The incidence of SRMs has significantly increased over recent decades, primarily attributed to the widespread use of cross-sectional imaging, with most detected incidentally during evaluation for unrelated conditions [2,3].

Epidemiology and Natural History

Approximately 30% of surgically excised SRMs are benign [4,5], and among malignant SRMs, the majority demonstrate indolent behaviour. The risk of malignancy increases with tumour size, from around 60% for masses <1.0 cm to approximately 85% for those 3.0-4.0 cm [6]. Similarly, metastatic potential correlates with size, with synchronous metastasis rates ranging from ~2% for masses <1.0 cm to ~4% for those 3.0-4.0 cm [7]. Most SRMs exhibit slow growth rates with limited metastatic potential during surveillance [8,9]. We present three cases who all presented and were assessed at Royal Darwin Hospital, in the Northern Territory Australia, during the 2024/2025 period. Each case provides an exception to the current standard presentation and behaviours of SRMs.

Case 1

This case is of a male in his early 50s who presented with gradual onset back pain, reported altered sensations and subjective weakness to his right leg, as well as a 6 week period of escalating immobility from fully active almost bed-bound. Upon further investigation CT lumbar spine showed a lytic lesion L3, extending into the right pedicle and lamina with associated epidural disease on the right, and concurrent extension into the L2-3 and L3-4 intervertebral lamina – overall appearances favouring more metastatic picture than a primary lesion. Further assessment with CT abdomen-pelvis to assess for a primary then demonstrated a solid mass lesion arising from the lower lateral left kidney concerning for primary right renal cell carcinoma – measuring 40 x 39 x 38 mm – and potentially more bony metastases with a destructive lesion seen anterior right 4th rib and sternum. An MRI spine confirmed metastatic lesions to L3 and identified 2 further possible lesions to the vertebral body of S1, and within the iliac bone adjacent the SI J on the left-hand side. He underwent urgent spinal embolization and stabilisation of L3 and S1 lytic lesions. Biopsy was obtained of their spinal tumour, which returned with features compatible with metastatic clear cell renal cell carcinoma. Immunohistochemistry: +ve for pan-cytokeratin AE 1/3, PAX 8, CD 10, and CAIX, Inhibin negative. PET Scan demonstrated further uptake to left maxilla, in an area not amenable to resection.

This patient is now awaiting chemotherapy/radiation therapy directives for ongoing management.

Case 2

Second we report a case of a male in his late 60s presenting with a 3-month history of atraumatic upper back ache. He was eventually investigated with a CT which revealed a 3.5 cm left upper pole renal mass without local invasion or lymphadenopathy, alongside multiple sclerotic lesions in the pelvis and upper vertebral bodies that displayed atypical radiographic features for RCC metastases. Laboratory workup showed normal tumour markers (PSA 0.86, CA19.9 16, CEA 2.5). Whole-body bone scan demonstrated non-specific increased uptake in the posterior ribs, while PET imaging showed only marginal FDG avidity (SUVmax 4.2) in the renal lesion and no hypermetabolic bone lesions. Renal mass biopsy revealed a provisional diagnosis of Grade 1 papillary RCC with immunohistochemistry positive for CK7 and AMACR but negative for CD10. The bone lesions were deemed unsuitable for biopsy, leaving their aetiology uncertain. While alternative diagnoses including myeloma were considered, normal haemoglobin, calcium, and protein levels suggested metastatic disease as most likely. He underwent a left laparoscopic partial nephrectomy which confirmed a Papillary renal cell carcinoma, 20mm, WHO/ISUP grade 2. He is now under close monitoring for their bony lesions.

Case 3

Finally, we present a third case of a male in his late 50s with incidentally detected metastatic clear cell renal cell carcinoma following investigation for unrelated chest pain and bilateral pleural effusions. Initial CT chest in October 2024 revealed an incidental left renal mass, prompting further evaluation with CT IVP on October 28, 2024, which confirmed a 34 mm left kidney lesion radiographically consistent with RCC. Concurrent imaging demonstrated multiple bone lesions involving the posterior acetabulum, left iliac crest, lumbar spine, and mid-thoracic spine, raising concern for metastatic disease. Subsequent left iliac bone biopsy performed on November 2024, revealed bone marrow replacement by epithelioid tumour cells with immunohistochemistry weakly positive for PAX8 and negative for CK7/CK20, confirming metastatic RCC. Immunotherapy with combination ipilimumab and nivolumab was initiated on December 2024.

Discussion

These three cases collectively challenge the conventional understanding of small renal masses and their metastatic potential. Case 1 highlights the diagnostic challenges presented by SRMs with unusual metastatic patterns, which can exhibit unexpected aggressive behaviour despite favourable histologic grading and small size characteristics that typically predict low metastatic potential. Case 2 demonstrates an uncommon presentation of a small renal mass with widespread metastatic disease at initial diagnosis, further challenging the general understanding that small renal tumours typically exhibit limited metastatic potential and underscoring the heterogeneity of renal cell carcinoma biology. Case 3 describes a patient with RCC and widespread bony metastases who experienced rapidly disabling symptoms developing over just a few weeks, prompting reconsideration of the conventional portrayal of small renal masses as predominantly slow-growing indolent lesions. Together, these cases emphasize the importance of thorough staging and individualized risk assessment for all renal masses, regardless of size, as exceptions to typical clinical patterns can significantly impact patient outcomes and management strategies.The below table demonstrates the metastatic patterns of the most common RCCs (Table 1). It should be noted all our SRM's had metastasised exclusively to bone. Given the different subtypes; two cases of clear cell and one of type 2 papillary, it is unclear why no other viscera or lymph

RCC Subtype	Approximate Prevalence	Metastatic Potential	Common Metastatic Sites	References
Clear Cell RCC	75-85%	High (approximately one-third present with advanced disease; 20-30% of localised cases develop metastases later)	1. Lungs (45-70%) 2. Bone (30-33%) 3. Liver (12-20%) 4. Brain (5-10%) 5. Adrenal glands (5-10%) 6. Unusual sites: pancreas, thyroid, skin	[10-12]

Papillary RCC Type 1	10-15% (combined papillary)	Low-Moderate (8.7% metastatic at diagnosis; less aggressive than Type 2)	1. Lymph nodes (69% in combined pRCC; higher than other subtypes) 2. Lungs 3. Liver (23% in combined pRCC) 4. Bone (29% in combined pRCC; less frequent than ccRCC)	[11,13,14]
Papillary RCC Type 2	Subset of papillary RCC	High (30% metastatic at diagnosis; significantly more aggressive than Type 1)	1. Lymph nodes 2. Lungs 3. Liver (more common than Type 1) 4. Bone	[11,13,14]
Chromophobe RCC	5-10%	Low (5-6% of cases metastasize)	1. Lymph nodes (51%) 2. Lungs (36%) 3. Liver (34%; proportionally higher than other subtypes) and Bone (33%)	[11,14]
Collecting Duct Carcinoma	<1% (0.4-1%)	High (49% with regional lymph node involvement at diagnosis; 19% with distant metastases)	1. Regional lymph nodes (49%) 2. Bone 3. Lungs 4. Liver	[15]
Renal Medullary Carcinoma	<0.5%	Extremely high (78% metastatic at diagnosis; associated with sickle cell trait)	1. Regional lymph nodes (82%; retroperitoneal) 2. Lungs 3. Liver 4. Bone 5. Adrenal glands	[16,17]

Table 1: Metastatic Patterns Of Renal Cell Carcinoma Subtypes (Updated 2025).

nodes were involved. Detailed genetic analysis and sequencing was not conducted on these tumours and therefore potential common oncogenic pathways have not been assessed. Immunohistochemistry conducted was also diverse with variations in CD expression across all three cases and no clear common expression pattern. A larger study on metastatic SRM with associated sequencing data could provide insight into genetic pathways which may preference these tumours to bone metastasis. Such results could play more of a role in future therapies especially in the role of biomarker identification for high risk SRMs given the reduced heterogeneity often seen in these cancers.

Conclusion

Management of SRMs requires a multidisciplinary, individualized approach based on tumour characteristics, patient factors, and preferences. The expanding evidence base is supporting active surveillance and ablative therapies as alternatives to surgical excision. This case series highlights the importance of comprehensive initial work up to identify the rare but damaging metastatic small renal mass.

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