A Practical Review of the Diagnosis and Management of Small Renal Masses

Abstract

The incidence of small renal masses (SRMs) has risen steadily over time, and SRMs now represent the majority of newly diagnosed renal lesions. Approximately 80% of newly diagnosed SRMs will be malignant. However, identifying a benign versus malignant lesion non-invasively can be difficult since no distinct imaging characteristics or growth patterns exist between the two. We have witnessed concurrent improvements in treatment strategies for small, localized tumors and have gained a better understanding of their natural history. Along with these changes there has been a shift in the manner in which we diagnose and treat SRMs. Although surgery remains the standard of care, we can now offer a variety of therapies individualized to the patient.

Keywords: Kidney cancer, small renal mass, diagnosis, treatment

Introduction

Small renal masses (SRMs) are currently defined as kidney lesions measuring ≤4 cm in diameter. The overall incidence of renal masses has risen steadily, reaching a plateau only in recent years, and the steepest rise has been demonstrated among SRMs. The current incidence is approximately 10.8 per 100,000 in the United States, with localized stage I disease representing >50% of all newly diagnosed renal tumours. Most of this rise in incidence is due to increased use of imaging techniques (CT, ultrasound) with the majority of newly diagnosed tumours presenting incidentally and asymptotically.

Subsequently, the landscape of this disease has shifted to a greater prevalence of small, localized tumours, and our approach to these tumours has evolved in parallel. SRMs are a heterog-
Saratiches plural of SRMs are a heterogeneous group consisting of both benign and malignant diseases. Approximately 80% of incidentally found SRMs, however, still represent a malignancy. Among these malignant tumours, the majority will consist of renal cell carcinoma (RCC) and its various subtypes. The most common histologic subtype of RCC is clear cell (70-80%), followed by papillary—types I and II (10-15%), and chromophobe (3-5%). Each subtype has a specific genetic basis and a distinct pattern of behaviour over the long term. The remaining 20% of SRMs will be of benign histology with angiomyolipoma and oncocytoma representing the most commonly diagnosed lesions.

**Diagnosis**

The vast majority of SRMs are discovered incidentally, and the symptomatic presentation of a renal tumour is now an uncommon occurrence. The classic triad of hematuria, flank pain, and abdominal mass rarely applies in today’s setting. Occasionally patients with SRMs complain of abdominal pain and fatigue.

Although technical advances in cross-sectional imaging and its broadened utilization has rapidly advanced our detection of SRMs, significant shortcomings remain regarding its ability to accurately characterize these lesions. In the majority of cases, current techniques cannot differentiate between malignant and benign tumours. The only exception is in cases where fat is unequivocally identified within the tumour, representing an angiomyolipoma and thus confirming the diagnosis of a benign lesion. This has created the predicament of increased diagnoses of SRMs of uncertain malignant potential.

Because of this dilemma, there is an emerging role for percutaneous renal mass biopsy, which is the current diagnostic gold standard short of extirpative surgery. Contemporary studies have demonstrated both the accuracy and the safety of percutaneous renal biopsy, confirming it as a reliable diagnostic approach. Despite this, utilization of this technique remains low in general practice, but will likely gain traction in the coming years as experience and expertise in renal biopsy grow.

A final aspect to be considered is the necessity of a complete evaluation at the time of initial diagnosis. Although the metastatic potential of SRMs remain low, it is still essential to perform some basic tests to ensure that there is no evidence of metastatic disease. The most recent recommendations from The Canadian Kidney Cancer Forum (2011) suggest the initial evaluation should include a complete history and physical, abdominal and pelvic CT, laboratory tests (CBC, LDH, electrolytes, creatinine, glucose, liver function tests, urinalysis, and urine cytology), and chest x-ray.

**Natural History**

We have made significant progress in
recent years in our understanding of the natural history of SRMs and this new knowledge has driven a shift in our approach to management. In the past, all renal tumours were treated as a malignancy. We now know that this is not true and that the rates of malignancy are strongly related to tumour size. Among patients presenting with SRMs, malignancy rates of approximately 20% have been reported across several surgical series, with as many as 46% of tumours <1cm representing benign disease.4

We have also developed a better understanding of the heterogeneity of the growth and behavior of these tumours. The average growth rate of a SRM is approximately 0.25–0.34cm/year.10-12 More importantly, we now realize that there is no significant difference in growth rates between benign and malignant tumours.13 Therefore, tumour growth rates are not a reliable indicator of malignancy and cannot be used to differentiate between benign and malignant disease.

Finally, it is important to realize that although the metastatic poten-
tial of SRMs is low, metastatic progression does rarely occur in small tumours. Approximately 1.0% of SRMs initially placed on active surveillance will progress and develop metastatic disease, though these tumours typically demonstrate rapid growth at the onset.\textsuperscript{10,12} Although the risk of metastatic progression is small, the consequences can be devastating.

**Treatment**

There is currently a range of treatment modalities and approaches that have been developed and refined in recent years. Treatment can be increasingly tailored to individual patients, resulting in a more complicated decision process. A simple, universal approach is no longer appropriate, and the risks and benefits of each approach must be weighed carefully. Urologists consider disease characteristics, patient comorbidities, and patient preferences to attain the best approach for the individual patient.\textsuperscript{14} Never before have we been able to offer so many options to the patient, and this field is continuing to evolve. Below, we review the major treatment options available for patients presenting with SRMs.
Radical Nephrectomy
Radical nephrectomy (RN) was historically the gold standard for treatment of all renal masses. This surgery involves removal of the entire kidney (including the renal tumor) as well as the surrounding fat, tissue, and ipsilateral adrenal gland. Though the standard for decades, RN is often unnecessary and treatment has shifted away from this approach for the management of SRMs. RN is currently indicated only for cases in which nephron-sparing surgery is not feasible.

Partial Nephrectomy
Partial nephrectomy (PN) is the current gold standard for surgical treatment of all SRMs. This procedure involves removing only the renal tumour and a small amount of surrounding renal parenchyma, thus leaving the majority of the kidney intact. Such an approach provides the benefit of preserving as much renal parenchyma as possible, while still adequately removing the renal tumour. When compared to RN, PN has been associated with improved renal function and may play a critical role in reducing the risk of cardiac morbidity and overall mortality. Importantly, 10-year cancer control and overall survival have been demonstrated to be equivalent between RN and PN for SRMs.

Ablative Therapies
In recent years we have witnessed...
Ablative therapies have proven to be a reasonable alternative in the treatment of SRMs, especially in elderly patients or those with significant comorbidities. This remains a viable option for patients at increased risk for undergoing a surgical procedure.

**Active Surveillance**

Active surveillance is the final treatment approach that must be considered. Surveillance strategies were historically reserved for either elderly patients or those with significant comorbidities who would not tolerate traditional surgical treatments and were ultimately managed with “watchful waiting”. In current practice, active surveillance is considered a reasonable option for all patients, especially given the further development and increasing acceptance of ablative therapies, most notably radiofrequency ablation and cryotherapy. Such approaches are much less invasive and are routinely performed through either a laparoscopic or percutaneous approach. These procedures are often performed on an outpatient basis and feature a quick recovery. Ablative therapies aim to destroy the tumour by either freezing (cryotherapy) or burning (radiofrequency) the tissue with the assistance of radiographic imaging (CT, ultrasound). Such approaches destroy the tumour, while preserving the remainder of the renal parenchyma. We now have data regarding intermediate follow-up of these patients with a 5-year recurrence-free survival rate of 90%.20
our better understanding of the overall rates of benign disease and the indolent nature of many of these tumours. The major benefit of such an approach includes the potential to delay or even avoid treatment in a subset of patients, while still retaining the ability to treat those whose tumours demonstrate more aggressive potential.

A potential barrier to further utilization of this strategy is our limited ability to identify tumours that require aggressive treatment from those that do not. Therefore, active surveillance is often used in conjunction with percutaneous renal biopsy to allow us to better characterize and stratify tumours prior to pursuing active surveillance. Even with a histological tumour diagnosis, however, variation exists in the behavior of these tumours, and patients on active surveillance require close monitoring typically with repeat imaging at 3-6 months intervals. Criteria to shift strategy to an active treatment include interval growth, dimensions approaching thresholds for certain therapies (ablative therapy, partial nephrectomy), or patient anxiety. Although surgery remains the standard of care for SRMs, active surveillance is an option in the appropriately selected patient and will likely be embraced further in coming years.

**Conclusions**

The management of small renal masses is a growing burden in current practice. Shifts in the prevalence of SRMs have necessitated adjustments in our treatment approach to this moving target. The future holds many more changes in the diagnosis and treatment of SRMs including the development of molecular markers to better characterize tumours and the further refinement of current treatment approaches. The ultimate goals of management will be to adequately treat these tumours from an oncologic standpoint, while minimizing morbidity to the patient both in the short and long term.
References


