Comparison of Reoperation and Local Recurrence Rates Between Metastasectomy, Intralesional Resection, or Stabilization Alone in the Treatment of Bone Metastases from Renal Cell Carcinoma

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INTRODUCTION: Bone metastases from renal cell carcinoma (RCC) present significant therapeutic challenges due to high metastatic potential and limited treatment options. This study compared local recurrence and surgical outcomes in patients with RCC and appendicular skeletal metastases treated with either stabilization alone, intralesional curettage, and metastasectomy.

METHODS:

We retrospectively identified 268 patients surgically treated for RCC bone metastases at two academic medical centers between December 1993 and January 2025. Primary outcomes were cumulative incidence of local recurrence and reoperation at 12 and 24 months post-surgery, while overall survival (OS) was the secondary outcome. Competing risks analysis was performed for primary outcome assessment, while OS was evaluated using Kaplan-Meier analysis.

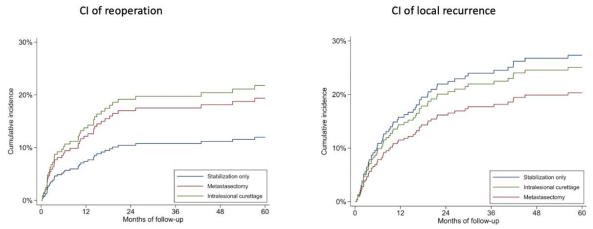
RESULTS:

Of 268 patients, 100 (37%) underwent stabilization-only, 102 (38%) metastasectomy, and 66 (25%) intralesional curettage. At 12 months, overall survival was 71.8% (metastasectomy), 64.1% (intralesional curettage), and 50.3% (stabilization-only); at 24 months, rates were 53.1%, 42.3%, and 26.6%, respectively (p=0.0001). Reoperation rates at 12 months were 7.4% (stabilization-only), 12.2% (intralesional curettage), and 13.8% (metastasectomy), at 24 months, they were 10.5%, 19.2%, and 17.0%, respectively. Local recurrence rates at 12 and 24 months were 15.8% and 22.0% (stabilization-only), 14.4% and 16.2% (intralesional curettage), and 7.4% and 16.2% (metastasectomy), respectively.

DISCUSSION AND CONCLUSION:

Metastasectomy demonstrated lower local recurrence rates compared to intralesional curettage and a trend toward reduced reoperation rates, suggesting potential benefits in managing RCC bone metastases. These findings support metastasectomy's role in optimizing local control, though survival differences warrant further investigation.

Figure 1. Cumulative incidence of reoperation and local recurrence by surgical strategy.



CI: cumulative incidence.

Table 1. Demographic, clinical, and treatment information of included patients.

	Entire cohort	Stabilization only	Metastasectomy	Intralesional curettage	p-value
N	269	100	102	66	
Age *	65.2 ± 10.2	65.8 ± 10.0	64.4 ± 10.5	65.5 ± 10.0	0.58
Female sex	85 (31.6%)	26 (26.0%)	37 (36.3%)	21 (31.8%)	0.29
BMI (kg/m2) *	29.2 ± 6.4	29.0 ± 6.3	28.8 ± 6.7	29.9 ± 6.3	0.68
Age adjusted CCI *	9.1 ± 2.1	9.2 ± 2.1	8.8 ± 1.7	9.3 ± 2.2	0.30
Hemoglobin (g/dl) *	11.3 ± 1.8	10.3 ± 1.6	11.9 ± 1.3	12.2 ± 1.9	**0.001**
Albumin (g/dL) *	3.7 ± 0.6	3.5 ± 0.5	3.9 ± 0.3	3.9 ± 0.6	**0.03**
ECOG score					0.28
0	24 (23.5%)	13 (25%)	8 (38%)	3 (11%)	
1	56 (54.9%)	29 (56%)	8 (38%)	19 (68%)	
2	12 (11.8%)	5 (10%)	4 (19%)	3 (11%)	
3	10 (9.8%)	5 (10%)	1 (5%)	3 (11%)	
Visceral metastasis	179 (66.5%)	81 (81.0%)	57 (55.9%)	41 (62.1%)	**<0.001**
Lung	155 (86.6%)	71 (88%)	48 (84%)	36 (88%)	0.82
Liver	27 (15.1%)	10 (12%)	7 (12%)	10 (24%)	0.17
Brain	29 (16.2%)	15 (19%)	9 (16%)	5 (12%)	0.67
Other sites	47 (26.3%)	25 (31%)	15 (26%)	7 (17%)	0.26
Multiple bone metastases	141 (52.4%)	63 (63.0%)	48 (47.1%)	29 (43.9%)	**0.02**
Pathological fracture	107 (39.8%)	46 (46.0%)	36 (35.3%)	24 (36.4%)	0.25
Histology					0.26
Clear cell	244 (91.4%)	91 (91.9%)	90 (88.2%)	63 (95.5%)	
Other	23 (8.6%)	8 (8.1%)	12 (11.8%)	3 (4.5%)	
Type of fixation					**<0.001**
Prosthesis	102 (38.1%)	8 (8.0%)	85 (83.3%)	9 (13.6%)	
IMN	87 (32.5%)	69 (69.0%)	1 (1.0%)	17 (25.8%)	
ORIF	58 (21.6%)	21 (21.0%)	8 (7.8%)	29 (43.9%)	
No hardware	21 (7.8%)	2 (2.0%)	8 (7.8%)	11 (16.7%)	
Cement use	143 (53.4%)	19 (19.0%)	69 (67.6%)	55 (83.3%)	**<0.001**
Negative margins	76 (80%)		76 (80%)		
Radiation therapy	148 (55.4%)	61 (61.6%)	52 (51.0%)	35 (53.0%)	0.29
Neoadjuvant RT	57 (38.5%)	15 (25%)	26 (50%)	16 (46%)	**0.01**
Adjuvant RT	90 (60.8%)	44 (72%)	24 (46%)	22 (63%)	**0.02**
Chemotherapy	169 (63.3%)	72 (72.7%)	55 (53.9%)	42 (63.6%)	**0.02**
Neoadjuvant QT	89 (52.7%)	41 (57%)	25 (45%)	23 (55%)	0.42
Adjuvant QT	123 (72.8%)	51 (71%)	41 (75%)	31 (74%)	0.88
Preoperative embolization	109 (40.7%)	24 (24.0%)	53 (52.0%)	32 (48.5%)	**<0.001**
Follow-up (months) *	27.2 ± 36.2	17.7 ± 22.2	36.8 ± 44.7	26.4 ± 35.2	**<0.001**
+ Mean ± standard deviation					

* Values displayed refer to the median ± standard deviation.

BMI: body mass index; *CCI*: Charlson Comorbidity Index; *ECOG*: Eastern Cooperative Oncology Group; *IMN*: intramedullary nailing; *ORIF*: open reduction and internal fixation; *QT*: chemotherapy; *RT*: radiation therapy.