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Do elderly patients benefit from surgery in addition to radiotherapy for treatment of metastatic spinal cord compression?

Almost 70% of all cancer-related deaths occur in elderly patients, generally defined as patients older than 65 years [4, 24]. It has been estimated that in 2030, the number of elderly patients dying of cancer will have more than doubled. Therefore, interest in these patients has increased considerably [3, 8, 18, 19]. One important question is whether elderly patients are able to withstand intensive anti-cancer treatments that are used in younger patients.

The incidence of metastatic spinal cord compression (MSCC) has increased during recent years, most likely because cancer patients live longer due to improved treatment for the primary tumor and metastases [2, 7, 13, 20, 22]. Radiotherapy alone is still the most common treatment for MSCC. However, a randomized trial of 101 patients suggested a benefit with regard to functional outcome and survival for decompressive spinal surgery followed by radiotherapy when compared to radiotherapy alone for selected patients [12]. In contrast to that randomized study, our matched-pair analysis of 324 patients did not identify a benefit for surgery in addition to radiotherapy [17].

Spinal surgery entails certain risks; the rate of serious surgery-related complications in the randomized trial of 101 patients was 12% associated with primary surgery and 40% associated with salvage surgery [12]. Due to the generally poorer pulmonary and cardiac function in elderly patients, anesthesia-related risks are more frequent than in younger patients. Therefore, one would prefer to avoid surgery in elderly patients when reasonably possible.

The question arises whether elderly patients with MSCC benefit from spinal surgery in addition to radiotherapy in terms of improved treatment outcome. This question would certainly be best answered in a randomized trial; however, such a trial is almost impossible to perform because most centers worldwide either do or do not prefer the additional surgery. Instead of a randomized trial, we performed a matched-pair analysis (1:2) following strict matching criteria and considering ten potential prognostic factors. This design was chosen in order to provide the highest level of evidence aside from a randomized trial. Surgery followed by radiotherapy and radiotherapy alone were compared for post-treatment motor function, local control of MSCC, and survival.

Methods

The data of 42 elderly (age > 65 years) patients who received surgery followed by radiotherapy for MSCC between 2000 and 2010 were matched 1:2 to 84 elderly patients from a database of 1,066 patients who received radiotherapy alone. The patients were matched for ten factors including age (≤ 70 versus > 70 years), gender, Eastern Cooperative Oncology Group (ECOG) performance score (1–2 versus 3–4), primary tumor (breast cancer versus prostate cancer versus myeloma/lymphoma versus lung cancer versus others), number of involved vertebrae (1–2 versus ≥ 3), other bone metastases (no versus yes), visceral metastases (no versus yes), ambulatory status before radiotherapy (not ambulatory versus ambulatory), time developing motor deficits before radiotherapy (1–7 versus > 7 days), and radiotherapy regimen (5 × 4 Gy versus 10 × 3 Gy versus 15 × 2.5 Gy/20 × 2 Gy). All of these factors matched between the three matched patients. The 126 patients included in this study had motor deficits due to MSCC of the thoracic or lumbar spine confirmed by MRI. Patients who had a vertebral body fracture with bony fragments compressing the spinal cord were not included in this study, as these patients were clearly candidates for decompressive surgery. The patients received 12–32 mg per day of dexametha-

Tab. 1 Patient characteristics

	Surgery + RT (n = 42) (n, %)	RT alone (n = 84) (n, %)
Age		
≤ 70 years (n = 63)	21 (50)	42 (50)
> 70 years (n = 63)	21 (50)	42 (50)
Gender		
Female (n = 39)	13 (31)	26 (31)
Male (n = 87)	29 (69)	58 (69)
ECOG performance status		
1–2 (n = 51)	17 (40)	34 (40)
3–4 (n = 75)	25 (60)	50 (60)
Type of primary tumor		
Breast cancer (n = 15)	5 (12)	10 (12)
Prostate cancer (n = 30)	10 (24)	20 (24)
Myeloma/lymphoma (n = 18)	6 (14)	12 (14)
Lung cancer (n = 24)	8 (19)	16 (19)
Other tumors (n = 39)	13 (31)	26 (31)
Number of involved vertebrae		
1–2 (n = 48)	16 (38)	32 (38)
≥ 3 (n = 78)	26 (62)	52 (62)
Other bone metastases at the time of RT		
No (n = 54)	18 (43)	36 (43)
Yes (n = 72)	24 (57)	48 (57)
Visceral metastases at the time of RT		
No (n = 75)	25 (60)	50 (60)
Yes (n = 51)	17 (40)	34 (40)
Ambulatory status before RT		
Not ambulatory (n = 51)	17 (40)	34 (40)
Ambulatory (n = 75)	25 (60)	50 (60)
Time developing motor deficits before RT		
1–7 days (n = 39)	13 (31)	26 (31)
> 7 days (n = 87)	29 (69)	58 (69)
RT regimen		
5 × 4 Gy (n = 6)	2 (5)	4 (5)
10 × 3 Gy (n = 60)	20 (48)	40 (48)
15 × 2.5/20 × 2 Gy (n = 60)	20 (48)	40 (48)

RT radiotherapy.

Tab. 2 Impact of potential prognostic factors on motor function

	Improvement (n, %)	No change (n, %)	Deterioration (n, %)	p
Treatment regimen				
Surgery + RT (n = 42)	9 (21)	26 (62)	7 (17)	
RT alone (n = 84)	20 (24)	55 (65)	9 (11)	0.39
Age				
≤ 70 years (n = 63)	15 (24)	40 (63)	8 (13)	
> 70 years (n = 63)	14 (22)	41 (65)	8 (13)	0.41
Gender				
Female (n = 39)	8 (21)	30 (77)	1 (3)	
Male (n = 87)	21 (24)	51 (59)	15 (17)	0.78
ECOG performance status				
1–2 (n = 51)	13 (25)	38 (75)	0 (0)	
3–4 (n = 75)	16 (21)	43 (57)	16 (21)	0.82
Type of primary tumor				
Breast cancer (n = 15)	3 (20)	12 (80)	0 (0)	
Prostate cancer (n = 30)	6 (20)	17 (57)	7 (23)	
Myeloma/lymphoma (n = 18)	5 (28)	13 (72)	0 (0)	
Lung cancer (n = 24)	7 (29)	15 (63)	2 (8)	
Other tumors (n = 39)	8 (21)	24 (62)	7 (18)	0.57
Number of involved vertebrae				
1–2 (n = 48)	11 (23)	34 (71)	3 (6)	
≥ 3 (n = 78)	18 (23)	47 (60)	13 (17)	0.65
Other bone metastases at the time of RT				
No (n = 54)	13 (24)	37 (69)	4 (7)	
Yes (n = 72)	16 (22)	44 (61)	12 (17)	0.64
Visceral metastases at the time of RT				
No (n = 75)	20 (27)	52 (69)	3 (4)	
Yes (n = 51)	9 (18)	29 (57)	13 (25)	0.20
Ambulatory status before RT				
Not ambulatory (n = 51)	11 (22)	29 (57)	11 (22)	
Ambulatory (n = 75)	18 (24)	52 (69)	5 (7)	0.12
Time developing motor deficits before RT				
1–7 days (n = 39)	5 (13)	22 (56)	12 (31)	
> 7 days (n = 87)	24 (28)	59 (68)	4 (5)	0.002
RT regimen				
5 × 4 Gy (n = 6)	1 (17)	1 (17)	4 (67)	
10 × 3 Gy (n = 60)	13 (22)	42 (70)	5 (8)	
15 × 2.5/20 × 2 Gy (n = 60)	15 (25)	38 (63)	7 (12)	0.79

RT radiotherapy.

sone from the time when MSCC was diagnosed until the end of the radiotherapy course. The patient characteristics related to the two treatment groups are summarized in **Tab. 1**.

Of the 42 patients treated with surgery plus radiotherapy, 27 patients received direct decompressive surgery plus stabilization of the involved vertebrae (DDSS) and 15 patients received a laminectomy (LE). Radiotherapy was administered with a linear accelerator using a single posterior field or parallel opposed fields depending on the depth of the spinal cord. The treatment volume encompassed one normal vertebra above and below the metastatic lesions.

Motor function was evaluated before and up to 6 months after radiotherapy with a 5-point scale [21]: 0: normal strength; 1: ambulatory without aid, 2: ambulatory with aid, 3: not ambulatory, 4: paraplegia. Improvement or deterioration of motor function was defined as a change of at least one point. In addition to the effect of treatment on motor function, both treatment groups were compared for local control of MSCC and survival. Data regarding the effect of treatment on pain relief were not available. Local control was defined as absence of neurological progression within the irradiated spine. Recurrence was defined either as a recurrence of motor deficits if therapy led to an improvement in motor function or as a progression of motor deficits if ther-

Abstract · Zusammenfassung

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Do elderly patients benefit from surgery in addition to radiotherapy for treatment of metastatic spinal cord compression?

Abstract

Background. Treatment of elderly cancer patients has gained importance. One question regarding the treatment of metastatic spinal cord compression (MSCC) is whether elderly patients benefit from surgery in addition to radiotherapy? In attempting to answer this question, we performed a matched-pair analysis comparing surgery followed by radiotherapy to radiotherapy alone.

Patients and methods. Data from 42 elderly (age > 65 years) patients receiving surgery plus radiotherapy (S + RT) were matched to 84 patients (1:2) receiving radiotherapy alone (RT). Groups were matched for ten potential prognostic factors and compared regarding motor function, local control, and survival. Additional matched-pair analyses were performed for the subgroups of patients receiving direct decompressive surgery plus stabilization of involved vertebrae (DDSS, n = 81) and receiving laminectomy (LE, n = 45).

Results. Improvement of motor function occurred in 21% after S + RT and 24% after RT (p = 0.39). The 1-year local control rates were 81% and 91% (p = 0.44), while the 1-year survival rates were 46% and 39% (p = 0.71). In the matched-pair analysis of patients receiving DDSS, improvement of motor function occurred in 22% after DDSS + RT and 24% after RT alone (p = 0.92). The 1-year local control rates were 95% and 89% (p = 0.62), and the 1-year survival rates were 54% and 43% (p = 0.30). In the matched-pair analysis of patients receiving LE, improvement of motor function occurred in 20% after LE + RT and 23% after RT alone (p = 0.06). The 1-year local control rates were 50% and 92% (p = 0.33). The 1-year survival rates were 32% and 32% (p = 0.55).

Conclusion. Elderly patients with MSCC did not benefit from surgery in addition to radiotherapy regarding functional outcome, local control of MSCC, or survival.

Keywords

Metastatic spinal cord compression · Elderly patients · Radiotherapy · Surgery · Treatment outcomes

Profitieren ältere Patienten von einer Operation zusätzlich zur Strahlentherapie bei der Behandlung der metastatisch bedingten Rückenmarkskompression?

Zusammenfassung

Hintergrund. Die Behandlung älterer Tumorpatienten hat an Bedeutung gewonnen. Diese „matched pair"-Analyse untersucht, ob ältere Patienten von einer Operation zusätzlich zur Strahlentherapie bei der Behandlung der MSCC profitieren.

Patienten und Methoden. Daten von 42 älteren (Alter > 65 Jahre) Patienten, die eine Operation plus Strahlentherapie (S + RT) erhalten hatten, wurden mit 84 Patienten verglichen (1:2), die mit alleiniger Strahlentherapie behandelt wurden. Die Paare mussten hinsichtlich 10 möglicher Prognosefaktoren übereinstimmen. Beide Gruppen wurden für die Endpunkte motorische Funktion, lokale Kontrolle und Überleben verglichen. Zusätzliche „matched pair"-Analysen erfolgten für die Subgruppen, die eine direkte Dekompression plus Stabilisierung erhielten (DDSS, n = 81), und für Patienten, die eine Laminektomie erhielten (LE, n = 45).

Ergebnisse. Ein Verbesserung der motorischen Funktion zeigte sich bei 21% der Patienten nach S + RT und bei 24% nach RT (p = 0,39). Die 1-Jahres-Raten für die lokale Kontrolle betrugen 81% und 91% (p = 0,44), die 1-Jahres-Überlebensraten 46% und 39% (p = 0,71). Bei Patienten, die eine DDSS erhielten, war eine Verbesserung der motorischen Funktion bei 22% nach DDSS + RT und 24% nach RT zu verzeichnen (p = 0,92). Die 1-Jahres-Raten für die lokale Kontrolle waren 95% und 89% (p = 0,62) und die 1-Jahres-Überlebensraten betrugen 54% und 43% (p = 0,30). Bei Patienten, die eine LE erhielten, zeigte sich eine Verbesserung der motorischen Funktion von 20% nach LE + RT und von 23% nach RT (p = 0,06). Die 1-Jahres-Raten für die lokale Kontrolle betrugen 50% und 92% (p = 0,33). Die 1-Jahres-Überlebensraten waren 32% und 32% (p = 0,55).

Schlussfolgerung. Ältere Patienten mit MSCC haben hinsichtlich motorischer Funktion, lokaler Kontrolle und Überleben gegenüber der alleinigen Strahlentherapie nicht von einer zusätzlichen Operation profitiert.

Schlüsselwörter

Metastatisch bedingte Rückenmarkskompression · Ältere Patienten · Strahlentherapie · Operation · Behandlungsergebnisse

apy resulted in no change of motor deficits. The clinical diagnosis of local failure of MSCC was confirmed with MRI. Local control and survival were calculated from the last day of radiotherapy. Patients were followed until death or for median of 9 months (range 3–42 months) in those alive at the last follow-up visit. Additional matched-pair analyses were performed for the subgroups of patients who received DDSS and patients who received LE.

Local control and survival rates were calculated with the Kaplan–Meier method [9]. The differences between the Kaplan–Meier curves were calculated with the Wilcoxon test. The prognostic factors significant ($p < 0.05$) in the univariate analysis were included in a multivariate analysis, performed with the Cox proportion hazards model. Because the radiotherapy regimen was administered based on the patient's prognosis (5 × 4 Gy given to patients with a very poor expected survival, 12 × 2.5 Gy/20 × 2 Gy given to patients with the most favorable prognosis), the radiotherapy regimen was not included in the multivariate of survival. Regarding functional outcome, a multivariate analysis including all factors was performed with the ordered logit model, as the data for functional outcome are ordinal (−1 = deterioration, 0 = no change, 1 = improvement).

Results

In the multivariate analysis of functional outcome, the time developing motor deficits before radiotherapy was significant

Tab. 3 Univariate analysis of local control

	At 6 months	At 12 months	p
Treatment regimen			
Surgery + RT (n = 67)	97	81	
RT (n = 134)	96	91	0.44
Age			
≤ 70 years (n = 63)	97	92	
> 70 years (n = 63)	95	83	0.19
Gender			
Female (n = 39)	100	90	
Male (n = 87)	94	86	0.21
ECOG performance status			
1–2 (n = 51)	96	87	
3–4 (n = 75)	97	92	0.99
Type of primary tumor			
Breast cancer (n = 15)	100	100	
Prostate cancer (n = 30)	100	91	
Myeloma/lymphoma (n = 18)	100	86	
Lung cancer (n = 24)	100	100	
Other tumors (n = 39)	86	71	0.14
Number of involved vertebrae			
1–2 (n = 48)	97	85	
≥ 3 (n = 78)	96	92	0.57
Other bone metastases at the time of RT			
No (n = 54)	98	87	
Yes (n = 72)	95	91	0.33
Visceral metastases at the time of RT			
No (n = 75)	98	89	
Yes (n = 51)	89	89	0.048
Ambulatory status before RT			
Not ambulatory (n = 51)	100	100	
Ambulatory (n = 75)	95	85	0.23
Time developing motor deficits before RT			
1–7 days (n = 39)	100	100	
> 7 days (n = 87)	97	87	0.39
RT regimen			
5 × 4 Gy (n = 6)	n.a.	n.a.	
10 × 3 Gy (n = 60)	100	100	
15 × 2.5/20 × 2 Gy (n = 60)	94	82	0.18
Entire cohort	96	91	

n.a. not available, **RT** radiotherapy.

(estimate +1.81; 95% CI +0.64 to +2.98; p = 0.002). The treatment regimen was not associated with functional outcome (estimate −0.12; 95% CI −0.97 to +0.74; p = 0.79). The results of the multivariate analysis of functional outcome are summarized in **Tab. 2**.

The local control rates for the entire cohort were 96% at 6 months and 91% at 12 months. On univariate analysis, improved local control was significantly associated with absence of visceral metastases (p = 0.048), whereas the treatment regimen was not significant (p = 0.44). In the Cox proportional analysis, visceral metastases were not significantly associated with local control (risk ratio (RR) 3.09; 95% confidence interval (CI) 0.41–16.48; p = 0.24). The results of the univariate analysis of local control are summarized in **Tab. 3**.

The survival rates for the entire cohort were 55% at 6 months and 42% at 12 months.

The results of the univariate analysis of survival are summarized in **Tab. 4**. In the univariate analysis, improved survival was associated with female gender (p = 0.012), better ECOG performance status (p < 0.001), favorable primary tumor type (p < 0.001), involvement of only 1–2 vertebrae (p < 0.001), absence of other bone metastases (p < 0.001), absence of visceral metastases (p < 0.001), ambulatory status prior to therapy (p < 0.001), slower development of motor deficits (p < 0.001), and longer-course radiotherapy (p < 0.001). The treatment regimen was not significantly associated with survival (p = 0.71). In the multivariate analysis, survival was significantly associated with ECOG performance status (RR 4.05; 95% CI 1.92–9.06; p < 0.001), visceral metastases (RR 3.29; 95% CI 1.93–5.75; p < 0.001), ambulatory status (RR 2.30; 95% CI 1.32–4.03; p = 0.003), and time developing motor deficits (RR: 1.98; 95% CI 1.15–3.44; p = 0.014). A strong trend was observed for other bone metastases (RR 2.89; 95% CI 0.96–9.39; p = 0.059). Gender (RR 1.43; 95% CI 0.82–2.62; p = 0.21), primary tumor type (RR 1.10; 95% CI 0.93–1.31; p = 0.25), and number of involved vertebrae (RR 1.32; 95% CI: 0.75–2.37; p = 0.35) were not significant.

In both treatment groups, acute radiation-related toxicity such as nausea, diarrhea, and skin reaction did not exceed grade 1 according to CTCAE 3.0. Late radiation toxicity such as myelopathy did not occur. Surgical complications such as wound infections, extensive bleeding, postoperative pneumonia, and pulmonary embolism occurred in 7 patients (14%) of the S + RT group.

In the subgroup analysis of the 81 matched patients who received DDSS, the results after DDSS + RT (n = 27) and after RT alone (n = 54) were not significantly different with respect to the effect on motor function (p = 0.92). The results of the comparison of DDSS + RT and RT alone are summarized in **Tab. 5**. In the subgroup analysis of the 45 matched patients who received LE, a trend was observed for posttreatment motor function in favor of RT alone (p = 0.06). Local control (p = 0.33) and survival (p = 0.55) were not significantly different (**Tab. 6**).

Tab. 4 Univariate analysis of survival

	At 6 months	At 12 months	p
Treatment regimen			
Surgery + RT (n = 67)	63	46	
RT (n = 134)	51	39	0.71
Age			
≤ 70 years (n = 63)	60	48	
> 70 years (n = 63)	50	35	0.07
Gender			
Female (n = 39)	67	62	
Male (n = 87)	50	33	**0.017***
ECOG performance status			
1–2 (n = 51)	92	86	
3–4 (n = 75)	30	12	**< 0.001***
Type of primary tumor			
Breast cancer (n = 15)	80	80	
Prostate cancer (n = 30)	43	26	
Myeloma/lymphoma (n = 18)	94	77	
Lung cancer (n = 24)	42	27	
Other tumors (n = 39)	45	33	**< 0.001***
Number of involved vertebrae			
1–2 (n = 48)	75	68	
≥ 3 (n = 78)	43	25	**< 0.001***
Other bone metastases at the time of RT			
No (n = 54)	78	70	
Yes (n = 72)	38	21	**< 0.001**
Visceral metastases at the time of RT			
No (n = 75)	83	65	
Yes (n = 51)	14	8	**< 0.001***
Ambulatory status before RT			
Not ambulatory (n = 51)	24	12	
Ambulatory (n = 75)	76	63	**< 0.001***
Time developing motor deficits before radiotherapy			
1–7 days (n = 39)	22	0	
> 7 days (n = 87)	70	58	**< 0.001***
RT regimen			
5 × 4 Gy (n = 6)	0	0	
10 × 3 Gy (n = 60)	44	31	
15 × 2.5/20 × 2 Gy (n = 60)	72	56	**< 0.001***
Entire cohort	55	42	

RT radiotherapy *Value considered significant.

Tab. 5 Additional matched-pair analysis of patients receiving direct compressive surgery plus stabilization of involved vertebrae (*DDSS*)

	DDSS+RT (n = 27)	RT alone (n = 54)	p
Treatment effect on motor function			
Improvement	6 (22)	13 (24)	
No change	20 (74)	37 (69)	
Deterioration	1 (4)	4 (7)	0.92
Local control of MSCC			
At 6 months	95	95	
At 12 months	97	89	0.62
Survival			
At 6 months	77	54	
At 12 months	56	43	0.30

MSCC metastatic spinal cord compression, **RT** radiotherapy.

Tab. 6 Additional matched-pair analysis of patients receiving laminectomy (*LE*)

	LE + RT (n = 15)	RT alone (n = 30)	p
Treatment effect on motor function			
Improvement	3 (20)	7 (23)	
No change	6 (40)	18 (60)	0.06
Treatment effect on motor function			
Improvement	3 (20)	7 (23)	
No change	6 (40)	18 (60)	
Deterioration	6 (40)	5 (17)	0.06
Local control of MSCC			
At 6 months	100	50	
At 12 months	92	92	0.33
Survival			
At 6 months	40	32	
At 12 months	43	32	0.55

MSCC metastatic spinal cord compression, **RT** radiotherapy.

Discussion

The most appropriate treatment for MSCC is controversial. For decades, radiotherapy alone has been the standard treatment. However, a randomized trial of 101 patients published in 2005 suggested that decompressive surgery followed by radiotherapy was superior to radiotherapy alone in terms of improved posttreatment ambulatory status, regaining the ability to walk, duration of ambulatory status after treatment, and survival [12]. In contrast, a matched-pair analysis of 324 patients considering 11 potential prognostic factors did not find a significant difference between surgery plus radiotherapy and radiotherapy alone regarding post-treatment motor function, ambulatory status, regaining ambulatory status, local control of MSCC, and survival [17]. Recently, a matched-pair analysis of 201 patients with unfavorable tumors such as NSCLC, cancer of unknown primary (CUP), renal cell carcinoma, and colorectal cancer suggested a better effect on motor function in the subgroup of patients who received DDSS + RT when compared to radiotherapy alone [16]. Thus, taking into account the current literature, the benefit of decompressive surgery in addition to radiotherapy is unclear and appears limited to selected patients, such as patients with MSCC from an unfavorable primary tumor, who have good performance status and relatively favorable survival prognoses.

Due to improved cancer therapies and demographic developments, the number of elderly cancer patients is constantly increasing. Because many of these patients have relevant comorbidity, they may be a challenge for the treating physicians. Cardiac and pulmonary comorbidities are likely to lead to increased surgery- and anesthesia-related complications. Many elderly patients are not able to withstand surgical procedures such as DDSS. Therefore, one would prefer to avoid spinal surgery in elderly patients whenever responsible. Thus, it is important to know whether elderly patients benefit from spinal surgery when added to radiotherapy in terms of improved treatment outcomes.

This matched-pair analysis of patients >65 years compared surgery followed by radiotherapy to radiotherapy alone. According to the present results, additional surgery did not lead to significantly improved functional outcome, local control, or survival. In addition, there was no significant improvement in patients who received decompressive surgery with stabilization or in those patients who had a laminectomy. The retrospective nature of this study must be taken into account when interpreting these results. Retrospective studies always bear a certain risk of a hidden selection bias. However, because a 1:2 matched-pair design was chosen and because each patient triple had to match for ten potential prognostic factors, the risk of such a bias was considerably reduced.

In the present study, posttreatment motor function was significantly associated with the time developing motor deficits before radiotherapy. This prognostic factor has been previously described as a significant predictor for functional outcome [15]. A slower development of motor deficits prior to the start of treatment for MSCC was associated with a better posttreatment motor function. This can be explained by the fact that a slower development of motor deficits represents a slower growing lesion. Slow onset of motor dysfunction may be due to the slow build up of pressure on the spinal cord causing venous congestion which is more likely to be reversible when compared to rapidly growing tumors which compress spinal arteries resulting in spinal cord ischemia and infarction [10, 23].

In the present study, local control of MSCC was not significantly associated with any of the investigated potential prognostic factors on multivariate analysis. Regarding the radiation regimen, this may have been due to the small number of patients treated with 5 × 4 Gy. A previous study has suggested that local control was better after 10 × 3 Gy, 15 × 2.5 Gy, or 20 × 2 Gy than after 1 × 8 Gy or 5 × 4 Gy [14]. Absence of visceral metastases was significantly associated with improved local control in the univariate analysis. In our previous matched-pair analysis of 324 patients of any age, visceral metastases were significantly associated with local control in both the univariate and the Cox proportional analyses [17]. The 1-year local control rates observed in the present study were considerably higher than in the study of Patchell et al. [12]. However, the Patchell study has been heavily criticized because of methodological problems including the extraordinarily poor results after radiotherapy alone.

In the multivariate analysis of this study, improved survival was associated with better ECOG performance status, absence of visceral metastases, ambulatory status before radiotherapy, and slower development of motor deficits. A strong trend was observed for absence of other bone metastases. The ECOG performance is correlated with the ambulatory status, which is known as a significant predictor of survival [1, 5, 6]. The negative impact of other bone metastases or visceral metastases on survival has also been previously described [11, 14]. A faster development of motor deficits reflects a more aggressive disease likely to be associated with a poorer survival prognosis. Patients treated with DDSS + RT had a non-significantly better survival than the patients treated with RT alone. This might have been due to a higher comorbidity of the patients in the RT alone group. However, data regarding the patients' comorbidity were not available.

Conclusion

Similar to our previous study including MSCC patients of any age [17], the present study of elderly (>65 years) patients did not suggest a significant benefit for decompressive surgery with stabilization or for laminectomy in addition to radiotherapy with respect to functional outcome, local control of MSCC, and survival. Surgery- and anesthesia-related risks are important particularly for elderly patients. Therefore, many of these patients appear better treated with radiotherapy alone.

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Conflict of interest. The corresponding author states that there are no conflicts of interest.

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