A study investigating the validity of modified Tokuhashi score to decide surgical intervention in patients with metastatic spinal cancer

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Abstract

Purpose Predicted survival of a patient is the most important parameter that helps to guide the treatment of a patient with metastatic spinal cancer. We aimed to investigate the reliability of modified Tokuhashi score in the decision-making process in patients with metastatic spinal cancer.

Methods We performed a review of our prospectively collected Metastatic Cancer Database over a period of 4 years (2007–2010). Ninety consecutive patients who were treated for metastatic spinal cancer were enrolled. Data review included demographic details, source of primary cancer, duration of symptoms, location of metastases, calculated Karnofsky's performance status, and calculated survival based on modified Tokuhashi score. We divided the patients into 3 groups. Group A included patients with expected survival less than 6 months. Group B included patients with expected survival between 6 and 12 months. Group C included patients whose expected survival was more than 12 months. We compared the calculated expected survival to the actual survival in all three groups with all patients following up to a minimum of 1 year or until death. Statistical analysis was done by Chi-square test and the Fisher Exact test.

Results The survival prediction in group C was significantly accurate in 80.9 % patients ($P = 0.027$). However, in groups A and B, only 36.1 and 9.1 % patients survived, respectively, as per predicted. ($P > 0.05$).

Conclusions We can conclude from this study that, when used alone, modified Tokuhashi score may not be a reliable tool to predict survival in all patient groups.

Keywords Surgical treatment · Modified Tokuhashi score · Metastatic spine cancer

Introduction

In recent years, there has been a gradual shift toward surgical management of metastatic spinal cancer followed by oncological management. This has been made possible because of various prognosis scoring systems, new surgical techniques, better techniques for chemo-radiotherapy, and the recognition of the need to maintain mobility and control pain in this special patient group. Overall expected survival of a patient is the most important parameter, which guides the treatment method used [1]. Many such scoring systems are used in this field including Tokuhashi, modified Tokuhashi, Tomita just to name a few [2–4].

We have routinely used the modified Tokuhashi score to predict the expected survival in our practice. This study investigated the reliability of the modified Tokuhashi score for predicting survival in patients with metastatic spinal cancer.

Methods

We performed a review of our prospectively maintained Metastatic Cancer Database over a period of 4 years

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(2007–2010). 90 consecutive patients treated for metastatic spinal cancer were included in this study.

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The pre-operative workup included magnetic resonance imaging of the whole spine, computed tomography of the chest and abdomen for staging purposes, and isotope bone scan to see any other skeletal lesions. All patients had surgical stabilization performed by three senior spinal surgeons. This included the posterior only approach, anterior only approach, or both anterior and posterior approach in combination staged or simultaneous. All patients were followed up for at least 1 year or until their death which ever was earlier.

The results were collated into three groups as suggested by the modified Tokuhashi Score. "Expected survival" was calculated by the pre-operative workup and calculated Karnofsky's performance status [5] by the modified Tokuhashi score. Group A included patients with expected survival less than 6 months. Group B included patients with expected survival between 6 and 12 months. Group C included patients whose expected survival was more than 12 months.

Statistical methods

Analysis of variance (ANOVA) has been used to find the significance of study parameters between three groups of patients; Chi-square/Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. Significance levels have been set at P value <0.05 . The Statistical software namely SPSS 15.0 was used.

Results

We reviewed 90 patients (45 males, 45 females) for final analysis. The mean age was 64 years (range 32–88 years). The most common site for metastatic deposits was the thoracic spine ($n = 36$) followed by lumbar spine ($n = 24$). Cervical spine accounted for 10 cases, and 20 cases had metastatic deposits in multiple regions. Primary cancers included breast ($n = 19$), hematologic [myeloma ($n = 17$), Lymphoma ($n = 13$)], Renal ($n = 9$), lung ($n = 9$), prostate ($n = 8$), and others ($n = 15$) (Table 1). Of the cases studied, 42 patients had posterior surgery alone, 12 patients had an anterior surgery alone, and 21 patients had both anterior and posterior procedures performed. 10 patients had kyphoplasty alone. 5 patients had only transpedicular biopsies.

Table 1 Type of tumor

Type of tumor	Number of patients	%
Renal	9	10.0
Prostate	8	8.9
Myeloma + lymphoma	30	33.3
Breast	19	21.1
Lung	9	10.0
Others	15	16.7
Total	90	100.0

Karnofsky's performance status calculation placed 32 patients in the 80–100 category, 36 patients in the 50–70 category, and the remaining 22 patients in 0–40 category. Based on the modified Tokuhashi score, calculated expected survival times revealed that 36 patients belonged to group A, 33 patients belonged to the group B, and the remaining 21 patients belonged to the group C. Of the 90 patients, 23 patients actually survived less than 6 months, 12 patients actually survived between 6 and 12 months, and the remaining 55 patients survived for at least 12 months after surgery.

42 patients presented with signs of neurologic deficit at presentation.

Individually, none of the parameters studied including gender, age, Karnofsky's performance status, modified Tokuhashi score, or neurologic deficit had any significant correlation with the actual survival ($P > 0.05$) (Table 2).

Table 2 Correlation of clinical variables with actual survival

Variables	Actual survival			<i>P</i> value
	<6 months (<i>n</i> = 23)	6–12 months (<i>n</i> = 12)	>12 months (<i>n</i> = 55)	
Gender				
Male	16 (69.6 %)	4 (33.3 %)	25 (45.5 %)	0.071
Female	7 (30.4 %)	8 (66.7 %)	30 (54.5 %)	
Age in years				
<60	5 (21.7 %)	6 (50 %)	22 (40 %)	0.184
>60	18 (78.3 %)	6 (50 %)	33 (60 %)	
Karnofsky's performance status				
<50	7 (30.4 %)	3 (25 %)	12 (21.8 %)	0.823
51–70	10 (43.5 %)	5 (41.7 %)	21 (38.2 %)	
>70	6 (26.1 %)	4 (33.3 %)	22 (40 %)	
Modified Tokuhashi score				
0–8	14 (60.9 %)	6 (50.0 %)	19 (34.5 %)	0.055
9–12	8 (34.8 %)	6 (50.0 %)	29 (52.7 %)	
13–15	1 (4.3 %)	0	7 (12.7 %)	
Nerve/cord compression symptoms				
No	11 (47.8 %)	6 (50 %)	31 (56.4 %)	0.765
Yes	12 (52.2 %)	6 (50 %)	24 (43.6 %)	

Table 3 Correlation of expected and actual survival

Expected survival	Total number of patients	Actual survival			<i>P</i> value
		0–6 months	6–12 months	>12 months	
0–6 months	36	13 (36.1 %)	6 (16.7 %)	17 (47.2 %)	0.082
6–12 months	33	9 (27.3 %)	3 (9.1 %)	21 (63.6 %)	0.700
>12 months	21	1 (4.8 %)	3 (14.3 %)	17 (80.9 %)	0.027
Total	90	23 (25.6 %)	12 (13.3 %)	55 (61.1 %)	–

In group A, only 13 (36.1 %) patients actually survived less than 6 months. Of the remaining, 17 (47 %) survived more than 12 months and 6 (16.6 %) survived between 6 and 12 months.

In group B, only 3 patients (9.1 %) followed the predicted survival times. Of the remaining 30 patients, 21 (63.6 %) patients lived for more than 1 year, and 9 (27.3 %) patients lived for less than 6 months.

In group C, 17 (80.9 %) patients survived for more than 12 months as predicted. One patient (4.7 %) survived for less than 6 months and 3 patients (14.3 %) survived between 6 and 12 months.

Actual survival was significantly associated with expected survival in group C. ($P = 0.027$). For groups A and B, this association did not reach significance levels. ($P > 0.05$) (Table 3).

For the subgroup that included hematologic malignancies, actual survival correlated significantly with the expected survival. ($P = 0.047$) For the remaining individual tumor groups, the correlation of actual survival did not reach significance levels ($P > 0.05$) (Table 4).

Postoperatively 6 patients had wound infection that needed antibiotics. Three of these patients needed washouts and one required vacuum pump dressings for healing. Three patients had post-operative pneumonia. One case had cement leak into the disk space. One case had pseudo-obstruction of bowel that was managed conservatively. In none of these cases, post-operative complications contributed to the death of any patient.

Discussion

There are many guidelines and recommendations to choose the best treatment for patients with metastatic spinal tumors. Various studies have suggested that the choice of surgical treatment depends on the type of primary cancer, the extent of disease spread, or based on bone destruction and neurologic compromise [6–9]. However, it was only after Tokuhashi's work that expected life expectancy was considered as the most important criteria for selecting treatment.

Table 4 Correlation of expected survival with actual survival in different type of tumor groups

Type of tumor/ expected survival (months)	Actual survival			<i>P</i> value
	<6 months (<i>n</i> = 23)	6–12 months (<i>n</i> = 12)	>12 months (<i>n</i> = 55)	
Renal				
<6	2	0	2	0.762
6–12	0	1	1	
>12	1	0	2	
Prostate				
<6	0	0	1	0.371
6–12	2	0	2	
>12	0	2	1	
Myeloma + lymphoma				
<6	4	0	2	0.047
6–12	3	1	14	
>12	0	0	6	
Breast				
<6	0	3	4	0.257
6–12	2	1	2	
>12	0	1	6	
Lung				
<6	4	2	2	1.000
6–12	1	0	0	
>12	0	0	0	
Others				
<6	3	1	6	1.000
6–12	1	0	2	
>12	0	0	2	

Based on our evaluation, 66.6 % (57 patients) had a different actual survival when compared to the Tokuhashi expected survival. That means, only 33.4 % (33 patients) actually followed the survivorship pattern as predicted by the revised Tokuhashi score. Only in the subgroup of hematologic malignancies did the actual survival correlate significantly with the expected survival.

In our study, the majority of patients belonged to myeloma and lymphoma subgroup. Their inclusion in research

on metastatic spinal cancer has been a matter of controversy. Original Tokuhashi and modified scores excluded them. However, Choi et al. [10] on behalf of the Global Spine Tumor Study Group have included myeloma and lymphoma to be one of the commonest causes of metastatic spinal cancer. Yilmazlar et al. [11], in their study, have also included myeloma and lymphoma cases in their comparison of prognostic scores in metastatic spinal cancer groups. In our study, 73.3 % of patients with myeloma survived more than 12 months. 53.3 % patients survived for more than 12 months; however, they were expected to survive less than this as per the Tokuhashi calculations. We also noted that the actual survival was better than the predicted survival for patients with lymphoma, breast-, prostate-, and renal cancer.

In 2005, Tokuhashi proposed his modified scoring system and applied it retrospectively in 246 patients concluding predictability of at least 75 % in all groups.

Jeon et al. [12] retrospectively applied revised Tokuhashi score in a group of patients treated between 1998 and 2005. They found that the revised Tokuhashi score may be a reliable tool in predicting the prognosis of metastatic spinal tumors.

On the analysis of our prospectively collected data, we had only 33.4 % accuracy in predicting the life expectancy. In our study, 38 patients (42.2 %) moved from groups A and B to group C. Based on calculations, these patients were considered for either conservative treatment or palliative surgery. If the survival prediction was more accurate, excisional surgery may also have been a consideration for this group (Table 3).

Pointillart et al. [1] have reported less than 60 % accuracy of revised Tokuhashi score. They suggested that the potential for rapid and maintained the improvement in clinical outcome, and the quality of life should be considered when selecting patients with metastatic spine disease for surgery rather than basing decisions solely on survival prognostic factors comprising current scoring systems.

Hessler et al [13] concluded that prediction of an individual's prognosis in the group of lung cancer patients, the score of Tokuhashi seems to be a suboptimal tool. They concluded that therapeutic decisions for such patients should be made based on interdisciplinary platforms, especially in the light of improved systemic treatment options. In our study, we had 44.4 % accuracy in the lung cancer subgroup.

Leithner et al. [14] studied seven different scoring systems that predict survival in metastatic spinal cancer cases. They concluded that Bauer and modified Bauer systems score best among the seven studied in terms of accuracy of prediction. They also suggested that myeloma cases should be included in the group with best prognosis in various scoring systems.

Conclusion

Though revised Tokuhashi score is useful in the decision-making process, predictability of survival is not accurate. Based on this study, we feel that, when used as a survivorship tool modified, Tokuhashi Score has good predictability in the group of patients who are expected to live more than 12 months. It may need further modifications to improve the predictability in the group of patients with life expectancy of less than 12 months.

Conflict of interest None.

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