

*Original Article***Is Tokuhashi score suitable for evaluation of life expectancy before surgery in Iranian patients with spinal metastases?**

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Abstract

BACKGROUND: One of the most important selection criteria for spinal metastases surgery is life expectancy and the most important system for this prediction has been proposed by Tokuhashi. The aim of this study was to evaluate predictive value of the Tokuhashi score for life expectancy in Iranian patients with spinal metastases one year after diagnosis.

METHODS: From February 2007 to March 2009, of 180 patients suffering spinal metastatic tumors, 71 patients were excluded. This left a study population of 109 patients with known malignant metastases to spine (56 females and 53 males; mean age, 57 ± 12 years). Tokuhashi revised evaluation system for the prognosis of metastatic spinal tumors was used for all patients. The survival period predicted by this system for the prognosis and the actual survival period after 1 year follow up were evaluated.

RESULTS: The predicted survival according to Tokuhashi prognostic scoring system was less than 6 months in 38(34.9%) patients, 6-12 months in 39(35.8%) patients and 1 year or more in 32(29.4%) patients. 39 (35.8%) patients died at first six-month of the follow up, 28(25.7%) patients at the second six-month period and 42(38.5%) patients were alive at the end of the year. There was no significant difference between predicted and actual survival time ($p = 0.116$).

CONCLUSIONS: Present study showed that the Tokuhashi revised scoring system may be practicable and highly predictive preoperative scoring system for patients with spinal metastases in Iran.

KEYWORDS: Spinal Metastasis, Prognosis, Life Expectancy.

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Metastatic spreads of cancer to the vertebral column is of significant clinical and epidemiological concern, and up to one third of all patients with cancer develop metastases to the spinal column.¹ This metastatic spread cause many clinical presentations such as pain, pathologic fracture, nerve deficit and irreversible deformity. All of these complications diminish quality of remaining life of patients.

According to the advances in radiotherapy and chemotherapy, choosing surgical treatment to reduce clinical manifestations of metastasis is controversial and has made a challenging situation for surgeons. On the other hand, one of these methods should inevitably be chosen to provide the maximum palliative effect and minimum negative side effects.²⁻⁴

There have been many factors involved in choosing the best treatment, but recent studies

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showed that predicting survival is the key factor in selecting the proper treatment modality.⁵⁻¹¹ Tokuhashi and colleagues proposed a point-addition-type scoring system for the preoperative prediction of the survival period to select treatment options in 1987.⁸⁻¹⁰ Afterwards, this scoring system was revised by him to evaluate the application of this assessment system for life expectancy for the groups receiving conservative treatment. Since 1998, the revised scoring system has been used wide spread.¹¹

In spite of the wide spread use of this scoring system, there is not any study that evaluated the predictive value and accuracy of the Tokuhashi revised score for life expectancy in patients with spinal metastasis. The aim of this study was to evaluate predictive value of the Tokuhashi score for life expectancy in patients with spinal metastases one year after diagnosis.

Methods

From February 2007 to March 2009, of 180 patients suffering spinal metastatic tumors that came to oncology and radiotherapy clinics of Firoozgar Medical Centre (Tehran, Iran), 71 patients were excluded. This left a study population of 109 patients with known malignant metastases to spine. All participants were given written informed consent. The study protocol was approved by the Ethic Committee of the Tehran University of Medical Sciences (Tehran, Islamic Republic of Iran).

We used revised version of the Tokuhashi scoring system¹² to evaluate life expectancy of patients with spinal metastasis after one year. The total score of this revised evaluation system was 15 (Table 1), which was the sum of the points of the following six items: general condition, number of extraspinal bone metastases, number of metastases in the vertebral body, presence or absence of metastases to major internal organs, site of the primary lesion, and the severity of palsy.^{10, 11} In patients with a total score of 8 or less (predicted survival period less than 6 months), conservative or palliative

procedures were selected. In patients with a total score of 9 to 11 (predicted survival period 6 months to 1 year), excisional procedures were rarely indicated in a single lesion without metastases to the major internal organs. In patients with a total score of 12 or more (predicted survival period 1 year or more), excisional procedures were selected.¹¹ Our sample were selected from all three groups. After one year, patients were divided to three groups based on Tokuhashi scoring system: (1) Patients whom their survival was accurately predicted ($n = 67$); (2) Patients whom Tokuhashi revised score overestimated their survival ($n = 16$) and (3) Patients whom Tokuhashi revised score underestimated their survival ($n = 26$). We compared the reliability of the prognostic criteria of the revised scoring system for these patients.

Statistical analyses

Kaplan-Meier, Cox regression and McNemar tests were used for analysis. Numerical data was presented as mean \pm standard deviation. $P < 0.05$ was considered significant. All tests were done with SPSS ver. 16.0 software (SPSS Inc., Chicago, IL).

Results

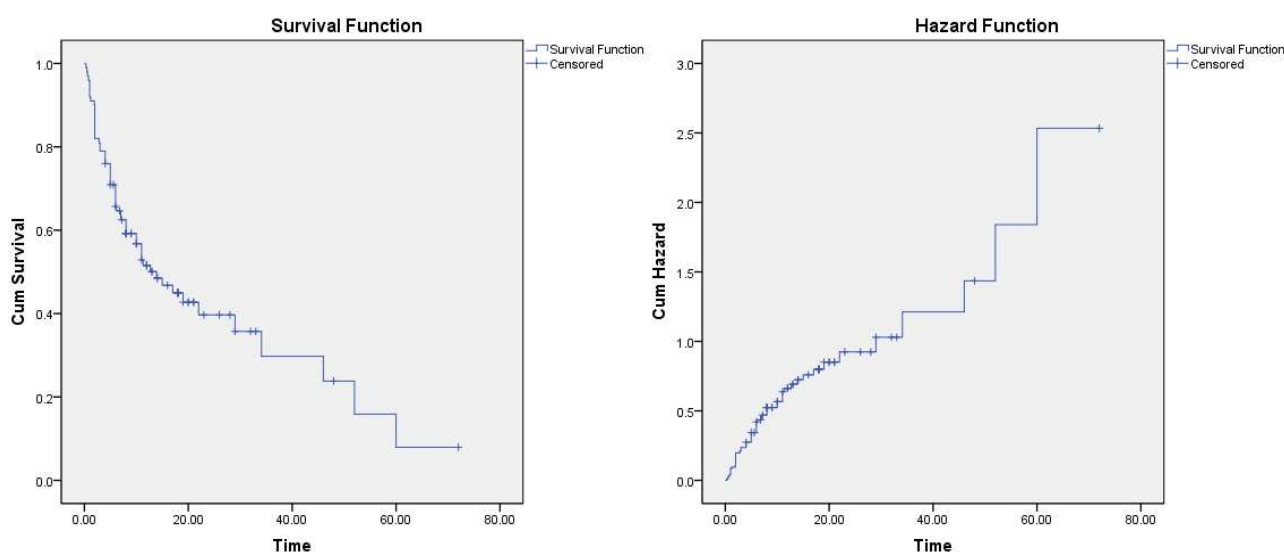
The mean age of 109 patients who were enrolled was 57 ± 12 years and 56 (51.4%) participants were female. At the beginning of the study, characteristics of Tokuhashi revised evaluation system were recorded for each patient (Table 1). Mean score of Tokuhashi revised evaluating system was 9.4 ± 2.9 . The actual survival time of patients was 24.92 months and the median of this time was 13.9 months. The survival and hazard function of patients are showed in figure 1.

The Tokuhashi revised evaluating system score estimated that after surgery, 38 patients should be alive less than 6 months, 39 patients 6-12 months and 32 patients may be alive more than 12 months. The actual survival time after 1 year follow up was as following: 39 patients less than 6 months, 28 patients 6-12 months

Table 1. Revised evaluation system for the prognosis of metastatic spine tumors and its frequency in this study participants

Characteristic	Score	N(%)
General condition (performance status)		
Poor (PS* 10%–40%)	0	6(5.5)
Moderate (PS 50%–70%)	1	69(63.3)
Good (PS 80%–100%)	2	34(31.2)
No. of extraspinal bone metastases foci		
≥ 3	0	47(43.1)
1-2	1	10(9.2)
0	2	52(47.7)
No. of metastases in the vertebral body		
≥ 3	0	78(71.6)
2	1	15(13.8)
1	2	16(14.7)
Metastases to the major internal organs		
Unremovable	0	32 (29.4)
Removable	1	3(2.8)
No metastases	2	74(67.9)
Primary site of the cancer		
Lung, osteosarcoma, stomach, bladder, esophagus, pancreas	0	18(16.5)
Liver, gallbladder, unidentified	1	4(3.7)
Others	2	13(11.9)
Kidney, uterus	3	2(1.8)
Rectum	4	3(2.8)
Thyroid, breast, prostate, carcinoid tumor	5	69(63.3)
Palsy		
Complete (Frankel A, B)	0	10(9.2)
Incomplete (Frankel C, D)	1	13(11.9)
None (Frankel E)	2	89(78.9)

* PS: Performance status

**Figure 1.** The survival and hazard function of patients

and 42 patients more than 12 months. Based on this result patients were divided into three groups:

- 1) Patients whom their survival was accurately predicted (28 + 16 + 23 = 67 members, 61.47%).
- 2) Patients whom Tokuhashi revised score overestimated their survival (7 + 4 + 5 = 16, 14.68%).
- 3) Patients whom Tokuhashi revised score underestimated their survival (7 + 3 + 16 = 26, 23.85%).

There was not any significant difference between second (overestimation) and third (underestimation) groups ($p = 0.116$).

In the Cox regression analysis, we examined whether sex or age of the patients had any interaction with Tokuhashi revised score and survival or not. Both of these two demographic variables removed from the model and the only effective factor on survival was Tokuhashi revised score (-2 log-likelihood = 376.051, chi-square = 57.48, $df = 1$ and $p < 0.001$). Finally for assessment of the effect of each characteristic of Tokuhashi revised evaluation system. We entered all of them in a Cox regression model. The only variable which removed from this model was number of extraspinal bone metastases foci ($p = 0.686$).

All of the other characteristics were significantly associated with the survival and entered to the model (Table 2, -2 log-likelihood = 380.788, chi-square = 71.313, $df = 5$ and $p < 0.001$). The most effective characteristic was number of metastases in the vertebral body. The next was general condition (Karnofsky's performance status). Palsy's significance level

was borderline ($p = 0.055$), so its association with survival is under question.

Discussion

There are many guidelines and recommendations to choose best treatment for patients with metastatic spinal tumors. Some authors¹³⁻¹⁵ argued that the choice of surgical treatment depends on the type of primary cancer and the extent of disease spread. A study recommended that treatment strategy should be chosen based on bone destruction and neurologic compromise.¹⁶ However, a recent study showed that the most important criteria is the expected life expectancy of the patient.¹⁰⁻¹³

To our knowledge, few studies evaluated predictive value of Tokuhashi score for life expectancy (which is a point-addition-type scoring system) one year after diagnosis. Oberdorfer and Grisold⁶ followed 38 patients with different primary tumors and showed that the Tokuhashi score decreased 3 months after various therapies from 0.8 to 2.4 score points. Enkaoua and colleagues¹³ confirmed the prognostic value of the Tokuhashi score but for unknown primary carcinoma recommended assigning no points. Riegel et al.¹⁷ showed a significant correlation between Tokuhashi score and survival of 139 patients. Present study confirmed the predictive value of the Tokuhashi scoring system in patients with spinal metastases caused by different primary tumors after one year. Life expectancy of patients with overestimation and underestimation did not have any statistically significant different. This finding is in concordance with the previous study.

Table 2. Tokuhashi revised score characteristics in the Cox regression model

Tokuhashi revised score characteristics	95% CI for Exp(β)							
	β	Exp(β)	Lower	Upper	SE	Wald	df	P-value
No. of metastases in the vertebral body	-0.92	0.4	0.25	0.65	0.25	13.9	1	< 0.001
General condition (performance status)	-0.61	0.54	0.32	0.92	0.27	5.21	1	0.022
Primary site of the cancer	-0.48	0.62	0.54	0.72	0.08	39.79	1	< 0.001
Metastases to the major internal organs	-0.45	0.64	0.48	0.85	0.14	9.68	1	0.002
Palsy	-0.43	0.65	0.42	1	0.22	3.7	1	0.055

According to our results, sex and age did not have any positive influence on survival of patients with spinal metastasis and based on Cox regression analysis these two items were excluded from predictive model. This result was the same as previous study which done by Hirabayashi and colleagues.¹⁸

The only item which was removed from Cox model was number of extraspinal bone metastases foci. This may be due to current diagnostic imaging techniques and disability of this technique to diagnose all extraspinal bone metastasis foci. However, all of the other characteristics had effect on the survival of patients and remained in the model. This finding was the same as previous study,⁹ but the position of this item differed from this study. It is

well accepted and has been demonstrated by several authors that primary tumor site is the most important prognostic factor of survival,¹¹ But our results showed that the most important prognostic factor for survival in Iran was number of metastases in the vertebral body. The primary tumor site in our study stayed in the 3rd position after general condition (Karnofsky's performance status). The importance of general condition is consistent with other studies.⁹⁻¹¹

In conclusion, the findings of the present study emphasized that the Tokuhashi revised scoring system seems to be practicable and highly predictive preoperative scoring systems for patients with spinal metastases in Iran.

Conflict of Interests

Authors have no conflict of interests.

Authors' Contributions

RM Idea making Data collecting and paper writing. FF Data collecting and paper writing. AkH Idea making Data collecting and paper writing. MAMJ Data collecting and paper writing. FGH Data collecting and paper writing.

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