

# Surgical Management of Spinal Metastases: The Postoperative Quality of Life

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**Objective:** The surgical treatment of spinal metastases remains controversial. Increasing life expectancy has resulted in greater interest in overall quality of life, pain and neurologic improvements. There are few prospective studies on functional and quality of life outcomes in patients with vertebral metastases. Therefore, the authors conducted the prospective study evaluating the clinical, neurologic function and quality of life after surgery in these patients.

**Material and Method:** Fifty-two patients undergoing surgical treatment for spinal metastases during October 2007 to October 2009 were prospectively evaluated. Surgical intervention included neurological decompression, fusion and spinal instrumentation. Pre- and post-operative assessments at 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month were performed using a visual analog scale, the modified Frankel grade classification and a Shortform-36 (SF-36).

**Results:** Pain scores were improved significantly at all post-operative time points ( $p < 0.001$ ). The neurological functions were improved at 1<sup>st</sup> month ( $p < 0.001$ ), 3<sup>rd</sup> month ( $p < 0.001$ ) and 6<sup>th</sup> month ( $p = 0.260$ ) postoperatively. At 1<sup>st</sup> month after surgery, 40 patients (76.9%) had improvement in quality of life. However, at 3<sup>rd</sup> month postoperatively, there were 31 patients (59.6%) improved. At 6<sup>th</sup> month postoperatively, only 15 patients (28.8%) were improved. Internal organ metastases was the only factor that related to the reduction of quality of life at 1 month, 3<sup>rd</sup> month ( $p < 0.001$ ) and 6<sup>th</sup> month ( $p < 0.05$ ).

**Conclusion:** Patients with spinal metastases will have benefit from palliative surgery in significant pain reduction and neurological recovery. As the global assessment in the quality of life, the patients may have the improvement at 1<sup>st</sup> month postoperatively but after 3 months and 6 months postoperatively, selected patients may have benefit from the surgery and the factors such as internal organ metastases and primary site of cancer have great effects on the improvement in the quality of life. This data may be useful for counseling the patients and relatives about the prognosis and expected surgical outcome before surgical intervention is decided.

**Keywords:** Spinal metastases, Quality of life, Outcome, Palliative surgery

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After the lung and the liver, the skeleton is the next most common site of metastasis from cancer and the spinal column is the most common site of bone metastases<sup>(1,2)</sup>. In patients over 40 years of age, metastatic lesions represent the majority of spinal tumors. Successful treatment depends on the extent of the tumor's involvement and often requires a multi-disciplinary approach involving surgery, chemotherapy and radiation therapy<sup>(3)</sup>. The decision on treatment of spinal metastases is determined by several factors, including the life expectancy and overall health of the

patient, biological properties of the primary tumors, the integrity of the spinal column, the patient's neurological status, the degree of pain, as well as the wishes of the patient and his/her family<sup>(4)</sup>. Options for treatment in metastatic disease involve a variety of modalities. The surgical treatment of spinal metastases remains controversial. Since 1990 Tokuhashi et al<sup>(5)</sup> has proposed the guideline treatment for spinal metastases. Tokuhashi's score has been widely used for evaluation and planning for the treatment but have not mentioned in quality of life and pain in the surgical decision making process. The patients who had Tokuhashi's scores less than 9 were recommended to have a conservative treatment but most patients were suffered from pain and poor quality of life. Furthermore, the past decade has been substantial improvements in the multi-disciplinary management of patients with metastatic disease. Advances in surgical techniques and newer

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generation spinal instrumentation have resulted in more effective surgical outcomes. The goals of the surgery are to provide symptomatic pain relief, prevent or reverse neurologic deficits, and restore the spinal instability. Surgery should be considered only if the anticipated improvement in pain, neurologic function and quality of life outweighs the risks of surgery. In general, the patients should have life expectancy more than 3 months before surgical intervention is decided<sup>(6)</sup>. Therefore, the patients in this group who meet an indication for surgery will be operated although the guideline suggested a conservative treatment. The indications for the surgery were progressive neurological deficit, intractable pain, need for histological diagnosis, radioresistant tumors, spinal instability and vertebral collapse with or without neurological complications<sup>(7)</sup>.

The major benefit of surgery was remained for improving the quality of life and reduction of pain<sup>(8-10)</sup>. Therefore, the overall health status including overall quality of life, pain and neurological status should be evaluated. After reviewing the literature, there are few prospective studies on the postoperative outcome and quality of life in metastases patients<sup>(11,12)</sup>. For this reasons, the authors conducted a prospective study evaluating clinical, functional and quality of life outcomes of palliative surgery in patients with vertebral metastases and identified factors that had influenced in the surgical outcome in these patients.

### Material and Method

At a single academic tertiary care center, a consecutive cohort of 69 patients presented with bony spinal metastases who had Tokuhashi's scores less than 9 and had indication for surgery from October 2007 to October 2009 were evaluated. At the date of admission, a general baseline and demographic data of each patient were collected. The quality of life was evaluated by using the Shortform-36 (SF-36) in Thai version<sup>(13,14)</sup>, pain scores were evaluated by using Visual Analog Scales<sup>(15)</sup>. The neurological assessed by modified Frankel grade classification of neurological function<sup>(16)</sup>. The surgical procedures were decompression, fusion and instrumented stabilization. All patients were evaluated prospectively on 1<sup>st</sup>, 3<sup>rd</sup> and 6<sup>th</sup> month after surgery. Postoperative reviews were performed by direct interview and physical examination of the patients during follow-up periods and by telephone interview if the patient could not come to the hospital. The patients who could not complete the questionnaire, had previous surgery of spinal

metastases and could not be contacted by telephone were excluded from the present study. Seventeen patients were excluded; therefore, the remained 52 patients were evaluated and included in the present study.

Confidence Interval Analysis (CIA) was performed at 95% confidence interval to assess difference of quality of life between pre-operation and post-operation. If the patients died or used respiratory support and cannot evaluate neurological examination, they were classified as non improvement of quality of life group and worse on neurological evaluation. Paired t-tests were used to assess the significant difference between pre-operative and post-operative Visual Analog Scale (rate 0-10)<sup>(15)</sup>. Wilcoxon signed rank test used for modified Frankel grade classification of neurological function<sup>(16)</sup>. In the subgroup analysis, the Pearson Chi-square correlation, Fisher's exact test and t-test were used to determine the factors that related to improvement in postoperative quality of life<sup>(13,14)</sup>.

### Results

There were 33 men and 19 women with a mean age of 55.5 years (22-86 years).

The most common sites of primary tumor were lung, prostate, breast and multiple myeloma. The most common site of involvement was the thoracic spine (29 patients, 58%). There were 16 cases (30%) involving the lumbar spine and 5 cases (10%) involving the cervical spine. There was one case involving both cervical and thoracic spine. The other one had metastases involving thoracic and lumbar spine (Table 1).

All patients were classified in the class 4 and 5 of Harrington classification<sup>(17)</sup>. Vertebral collapse with mechanical pain or instability without significant neurological involvement (class 4, 17%) or with major neurological involvement (class 5, 83%). Most of the cases were evaluated for other metastases. Fifteen patients (29%) had internal organ metastases such as lung, liver or brain metastases and 22 patients (42%) had extraspinal bone metastases and 23 patients (44%) had neither internal organ nor extraspinal metastases (Table 1).

Anterior approach was performed in 6 patients (11.5%), posterior approach was performed in 45 patients (86.5%) and combined approaches in 1 patient (1.9%). Twenty-seven patients (51.9%) had one level involvement and 25 patients (48.1%) had more than one level involvement (Table 2). The average of operative time was 177 minutes (153-185 minutes) and

**Table 1.** Characteristics of patients

Primary cancer	No metastases	Metastases to bone*	Metastases to internal organ**	Level of involvement (level = case)#	Total
Lung	9	3	0	C = 2 T = 4 L = 3 CT = 1 TL = 1	12 (23.1%)
Prostate	4	4	1	T = 7 L = 2	9 (17.3%)
Breast***	5	3	3	T = 6 L = 2	8 (15.4%)
Multiple	1	4	1	T = 3 L = 2	5 (9.6%)
Myeloma***					
Lymphoma	1	3	0	T = 3 L = 1	4 (7.7%)
Cervix***	0	1	2	L = 2	2 (3.8%)
Bile duct***	0	1	2	C = 1 T = 1	2 (3.8%)
Liver	0	0	1	T = 1	1 (1.9%)
Thyroid gland	0	0	1	L = 1	1 (1.9%)
Thymus gland	0	0	1	T = 1	1 (1.9%)
Adrenal gland	1	0	0	L = 1	1 (1.9%)
Nasopharynx***	0	1	1	T = 1	1 (1.9%)
Germ cell	0	0	1	T = 1	1 (1.9%)
Endometrium	1	0	0	L = 1	1 (1.9%)
Unknown	1	3	1	C = 1 T = 1 L = 1	3 (1.9%)
Origin***					
Total***	23	22	15	C = 5 T = 29 L = 16 CT = 1 TL = 1	52 (100%)

\* mean as other bones despite spine, \*\* including lung, liver, brain, \*\*\* Some patients had both other bones and internal organ metastases, # C = cervical spine, T = thoracic spine, L = lumbar spine, CT = cervical and thoracic spines, TL = thoracic and lumbar spines

**Table 2.** Surgical Procedure in 52 patients

Surgical procedure	Number of procedure	Improvement after 1 month	Improvement After 3 months	Improvement After 6 months
Anterior approach	6 (11.5%)			
Anterior corpectomy + cement	1	1	0	0
Anterior corpectomy + autograft + instrumentation	1	1	0	0
Anterior corpectomy + cement + instrumentation	4	3	3	1
Posterior approach	45 (86.5%)			
Laminectomy	9	6	4	3
Instrumentation	2	1	1	1
Laminectomy + instrumentation	30	23	20	9
Laminectomy + autograft + instrumentation	4	4	2	1
Combined approach	(1.9%)			
Anterior corpectomy + cement + instrumentation + posterior instrumentation	1	1	1	0
Total	152 (100%)	40	31	15

average blood loss was 691 milliliters (554-720 milliliters). Fifteen patients (28%) had post-operative complications such as pulmonary embolism, pneumonia,

postoperative wound dehiscence, sepsis, deep vein thrombosis, upper GI hemorrhage and seizure. Comparing the rate of complications in the present

study with previous studies in spinal metastatic patients, the authors found no significant difference among these studies<sup>(8-10)</sup>.

Three patients (5.8%) died at 1 month postoperatively. One patient died from pulmonary emboli after operation, one died from sepsis and the other died from multiple organ failure because of internal organ metastases. One patients developed pneumonia postoperatively and needed respiratory support and died within 3 months. 11 patients (21.2%) died in 3 months postoperatively and 23 patients (44.23%) died in 6 months postoperatively. All of them were included in non-improvement group for the quality of life analysis.

Pain scores were improved both at 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month postoperatively. At 1<sup>st</sup> month postoperatively, pain score was improved from 7.90 to 3.07 ( $p \leq 0.001$ ), at 3<sup>rd</sup> month postoperatively pain score was improved from 7.90 to 3.02 ( $p \leq 0.001$ ) and at 6<sup>th</sup> month postoperatively pain score was improved from 7.90 to 2.14 ( $p \leq 0.001$ ) (Table 3), (Fig. 1).

The neurological functions were improved both at 1<sup>st</sup> month and 3<sup>rd</sup> month postoperatively. There were 30 cases improved, 5 cases worse, 14 cases not changed in 1 month postoperatively ( $p < 0.001$ ), there were 25, 5, 11 cases respectively in 3 months postoperatively ( $p < 0.001$ ) and there were 16, 5, 8 cases respectively in 6 months postoperatively ( $p = 0.260$ ) (Table 4), (Fig. 2).

At the 1<sup>st</sup> month postoperatively, the quality of life was improved in 76.9% (95% CI 63.9, 86.3) but at the 3<sup>rd</sup> month, quality of life was improved in 59.6% (95% CI 46.1, 71.8) and at 6 months postoperatively, quality of life was improved in 28.8% (95% CI 18.3,

42.3). (Table 5), (Fig. 3).

In the subgroup analysis for the factors related to the improvement of postoperative quality of life<sup>(13,14)</sup>, many factors were included for evaluation in the present study (Table 6). The authors found that the patients who did not have internal organ metastases was the only factor that related to improvement postoperative quality of life at 1<sup>st</sup> month, 3<sup>rd</sup> month ( $p \leq 0.001$ ) and 6<sup>th</sup> month ( $p = 0.012$ ).

## Discussion

The treatment of the patients who have spinal metastases is multimodality. However, the various

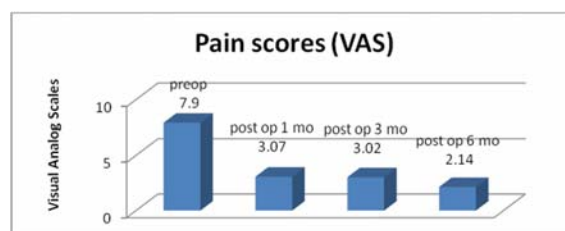


Fig. 1 Pain Scores (VAS)

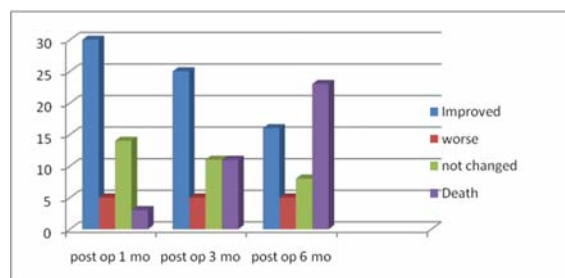


Fig. 2 Neurological measurement

Table 3. Pain Evaluation Using Visual Analog Scale (0-10) with Paired t-test Analysis

	Preoperative	post-operative 1 <sup>st</sup> month	post-operative 3 <sup>rd</sup> month	post-operative 6 <sup>th</sup> month
Mean	7.90	3.07	3.02	2.14
Std. Deviation	2.66	2.13	3.52	2.51
p-value		< 0.001	< 0.001	< 0.001

Table 4. Neurological Measurement Using Modified Frankel Classification with Wilcoxon Signed Ranks Test

Postoperative	Improved	Worse	Not changed	Death	Total	Asymp. Sig.(2-tailed)
1 month	30	5	14	3	52	< 0.0013
months	25	5	11	11	52	< 0.0016
months	16	5	8	23	52	0.260

treatment methods for these patients are only palliative and survival may be only a few months. Surgery is indicated only if the anticipated improvement in quality of life outweighs the risks. As in the previous studies, the aim of treatment in this group of patients remained for palliative care<sup>(3,18)</sup>. When the authors treated these patients following the Tokuhashi's recommendation<sup>(5)</sup>, the authors found many patients suffered from pain and poor quality of life. This was a burden for the caregivers and patient's relatives. Most of them had major depression from their sickness that led to short survival rate after spinal metastases. Therefore, the authors evaluated the results of surgical intervention

in this group of patients.

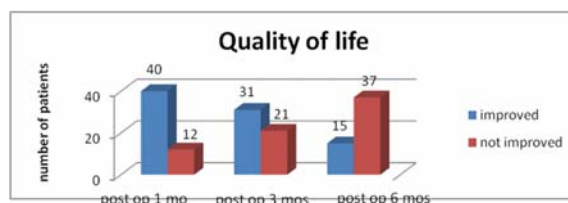
About 95% of patients came with back pain<sup>(19)</sup>, thus the pain was one of the parameters for post-operative evaluation<sup>(3,11,12)</sup>. As in the present study, Visual Analog Scales were significantly improved at 1<sup>st</sup> month, 3<sup>rd</sup> month and 6<sup>th</sup> month post-operatively.

Most of patients (83%) in the present study came with neurological involvement as in the class 5 of Harrington classification<sup>(17)</sup>. The Modified Frankel grades were improved significantly both at 1<sup>st</sup> month, 3<sup>rd</sup> month postoperatively. However, after 6 months, some patients were not improved because they died or could not be evaluated the neurological status. The results suggest that the patients who had symptoms of metastasis with spinal cord compression and the life expectancy was more than 3 months, surgery may improve the outcome of neurological status at 1<sup>st</sup> month, 3<sup>rd</sup> month post-operation. The pre-operative neurological status was an important factor that determined post-operative improvement. The authors found that in cases of pre-operative complete cord lesion, most patients had no improvement after surgical decompression. The post-operative functional activity improved only in cases of pre-operative moderate and good functional activity.

The follow-up period of the present study is short, as would be expected in a palliative population. The 3-month mortality rate was 21% and 6-month mortality rate was 45%. This is in concordance with postsurgical mortality rates reported in previous studies<sup>(5,23)</sup>. A life expectancy even shorter than 3 months may be justified to perform surgery if it can be shown or anticipated that the remaining global quality of life is improved<sup>(11)</sup>.

**Table 5.** Quality of Life Analysis Using Shortform-36 (SF-36) with Confidence Interval Analysis

Postoperative	not improved	improved
1 month	12 (23.1%)	40 (76.9%) (63.9, 86.3)
3 months	21 (40.4%)	31 (59.6%) (46.1, 71.8)
6 months	37 (71.2%)	15 (28.8%) (18.3, 42.3)



**Fig. 3** Quality of Life

**Table 6.** Subgroups Analysis of the Factors Related to Improved Post Operative Quality of Life

variables	Post op 1 mo; p-value	Post op 3 mos; p-value	Post op 6 mos; p-value
Gender	1.000	0.919	0.517
Age	0.917	0.638	0.070
Post op. major complications	0.451	0.128	0.179
Other skeletal bone metastases	0.343	1.000	0.942
Internal organs metastases	< 0.001	< 0.001	0.012
No. of spinal metastases levels	0.072	0.427	0.663
Operative time	0.688	0.531	0.672
Operative procedure	0.332	0.218	0.665
Estimated blood loss	0.227	0.929	0.320
Preoperative albumin levels	0.210	0.770	0.280
Preoperative hemoglobin levels	0.411	0.645	0.995
Preoperative lymphocyte count	0.872	0.420	0.583



There are limitations to the present study. It can still be very difficult to obtain complete follow-up on patients who were physically ill and in recovery after major surgery. Most of them lived far away from the hospital. The authors could not collect date of death of our patients in the present study. Therefore, survivorship analysis could not be analyzed. This may affect the results of neurological measurement and quality of life assessment because death patients were included in non-improvement group for statistical analysis. Therefore, the number of non-improved cases was high at 6<sup>th</sup> month postoperatively and should be considerate for interpretation of these results.

Subgroup analysis was verified and the authors found that if the metastatic spine patients came without internal organ metastases, it was significantly related to improvement of the quality of life at all postoperative time points. In the present study, if the primary sites were from hematologic or endocrine malignancy, there was a trend to improve the quality of life after surgery. However, if the primary sites were from lung or prostate, even the patients did not have other internal organ metastases, the improvement was only 2 patients from 12 patients with lung cancer. Many previous studies used the primary site for scoring of the life expectancy evaluation and guideline of treatment<sup>(5,20,21,22)</sup>. Therefore, the primary site may have an effect on the postoperative quality of life such as the patients with lung carcinoma and melanoma had the poorest average survival rates and disappointing results<sup>(3,5)</sup>. The complications of the surgery in the present study is about 28% that similar to previous studies in spinal metastatic patients<sup>(5,11,23)</sup>. Therefore, we can operate in this group of patients without higher rate of complications. The authors believe that surgical management is still justified in appropriate patients who are in reasonably good general health with no evidence of extensive visceral or other distant metastases.

In conclusion, patients who have spinal metastases may have benefit from palliative surgery especially pain reduction and neurological recovery. As the global assessment in the quality of life, the patients may have the improvement in the quality of life after 1 month postoperatively but after 3 months and 6 months postoperatively, selected patients may have benefit from the surgery and the factors such as internal organ metastases and primary site of cancer have great effects on the improvement in the quality of life. This data may be useful for counseling the patients and relatives during the surgical decision making process.

#### Potential conflicts of interest

None.

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## การศึกษาคุณภาพชีวิตของผู้ป่วยหลังผ่าตัดเนื้องอกที่กระจายไปที่กระดูกสันหลัง

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**วัตถุประสงค์:** การรักษาเนื้องอกที่กระจายมาที่กระดูกสันหลังโดยการผ่าตัดนั้น ในปัจจุบันยังไม่มีข้อสรุปที่เป็นมาตรฐาน ความคาดหวังของอายุหลังผ่าตัดที่เพิ่มขึ้น ทำให้ความสนใจเกี่ยวกับคุณภาพชีวิตของผู้ป่วย อาการปวดและการฟื้นตัวของระบบประสาทหลังการผ่าตัดเพิ่มมากขึ้น ซึ่งการศึกษาคุณภาพชีวิตของผู้ป่วยแบบศึกษาไปข้างหน้ายังมีน้อย ดังนั้น การศึกษานี้จึงจัดทำขึ้นเพื่อศึกษาคุณภาพชีวิตของผู้ป่วยหลังผ่าตัด เนื้องอกที่กระจายไปที่กระดูกสันหลัง

**วัสดุและวิธีการ:** โดยการเก็บข้อมูลแบบศึกษาไปข้างหน้าในผู้ป่วยที่มีเนื้องอกที่กระจายไปที่กระดูกสันหลังที่มารับการรักษาโดยการผ่าตัดในแผนกผู้ป่วยภาควิชาศัลยศาสตร์ออร์โธปิดิกส์และ กายภาพบำบัด โรงพยาบาลศิริราช จำนวน 52 ราย ตั้งแต่เดือนตุลาคม พ.ศ.2550 ถึง เดือน ตุลาคม พ.ศ. 2552 โดยประเมินอาการปวดการทำงานของระบบประสาทที่ถูกกดทับ และคุณภาพชีวิตของผู้ป่วยก่อนผ่าตัดและหลังผ่าตัดที่ 1 เดือน 3 เดือน และ 6 เดือน โดยใช้ Visual analog scale, modified Frankel grade classification และ Shortform-36 (SF-36) ฉบับภาษาไทยเป็นเครื่องมือในการประเมิน

**ผลการศึกษา:** พบว่าหลังผ่าตัดอาการปวดลดลงอย่างมีนัยสำคัญทั้งหลังผ่าตัดที่ 1 เดือน 3 เดือน และ 6 เดือน ( $p < 0.001$ ) การประเมินการทำงานของระบบประสาทที่ถูกกดทับ พบว่า มีการเปลี่ยนแปลงในทางที่ดีขึ้นหลังผ่าตัดที่ 1 เดือน ( $p < 0.001$ ) 3 เดือน ( $p < 0.001$ ) และ 6 เดือน ( $p = 0.26$ ) สำหรับการประเมินคุณภาพชีวิตโดยใช้ Shortform-36 (SF-36) ฉบับภาษาไทยนั้น พบว่าผู้ป่วย 40 ราย (76.9 เปอร์เซ็นต์) มีคุณภาพชีวิตดีขึ้น แต่หลังผ่าตัด 3 เดือนกลับมีผู้ป่วย ที่คุณภาพชีวิตดีขึ้นเพียง 31 ราย (59.6 เปอร์เซ็นต์) และที่ 6 เดือน มีผู้ป่วยที่คุณภาพชีวิตดีขึ้นเพียง 15 ราย (28.8 เปอร์เซ็นต์) เท่านั้น เมื่อนำมาวิเคราะห์ในกลุ่มย่อยพบว่า การที่ผู้ป่วยมีการกระจายของเนื้องอกไปที่อวัยวะภายใน มีความสัมพันธ์อย่างมีนัยสำคัญกับคุณภาพชีวิตหลังผ่าตัด 1 เดือน 3 เดือน ( $p < 0.001$ ) และ 6 เดือน ( $p < 0.05$ )

**สรุป:** จากผลการศึกษาจึงเชื่อได้ว่าการผ่าตัดผู้ป่วยที่มีเนื้องอกที่กระจายไปที่กระดูกสันหลังได้ประโยชน์อย่างชัดเจน ทั้งด้านการบรรเทาอาการปวด การดีขึ้นของเส้นประสาทที่ถูกกดทับ รวมถึง คุณภาพชีวิต 1 เดือนหลังผ่าตัด ส่วนการเปลี่ยนแปลงที่ดีขึ้นของคุณภาพชีวิต 3 เดือน และ 6 เดือน หลังผ่าตัดคงต้องพิจารณาในการเลือกผู้ป่วย เนื่องจากมีปัจจัยอื่นๆ ที่มีผล เช่น การกระจายของเนื้องอกไปยังอวัยวะภายในก่อนที่ทำการรักษา และชนิดของมะเร็งปฐมภูมิ ข้อมูลจากการศึกษานี้ น่าจะเป็นประโยชน์ในการให้คำปรึกษาแก่ผู้ป่วยและญาติเกี่ยวกับการพยากรณ์โรคและผลที่คาดว่าจะได้รับหลังการผ่าตัด และช่วยในการตัดสินใจในการเลือกรับการรักษาโดยการผ่าตัด

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