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## Factors predicting surgical outcome of spinal cord compression from extradural metastases

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**Background** : *Spinal cord compression from extradural metastases is the one of the most common complications of cancer. If untreated, the metastatic extradural compression may inexorably advance , causing paralysis, sensory loss and sphincter incontinence. Early diagnosis and prompt treatment have a major impact on the quality of life of the patient. The treatments are surgery and radiotherapy, either alone or in combination. It is possible to increase the success rate and decrease the surgical morbidity and mortality by improving the selection criteria of surgical candidates.*

**Objective** : *To identify factors predicting the surgical outcome of spinal cord compression from extradural metastases.*

**Setting** : *Neurosurgery Unit, Department of Surgery, Faculty of Medicine, Chulalongkorn University.*

**Design** : *Retrospective, observational and descriptive study.*

**Material** : *Forty-one metastatic extradural spinal cord compression patients operated at King Chulalongkorn Memorial Hospital from January 1993 to December 2000.*

**Methods** : *Review and data collected from OPD cards, clinical records, films and interview with patient or family members by telephone.*

**Results** : A total of 41 patients underwent operation for metastatic extradural spinal cord compression. There were 22 male and 19 female patients. The average age was 53.3 years. The most common cause was lung cancer in male and breast cancer in female., The compression at the thoracic level was found in 65.85 percent of the patient. Twenty-eight patients (68.3 %), the initial symptom of metastatic extradural spinal cord compression was progressive pain. The patients who presented with progressive pain as an their initial symptom had good outcome, significantly higher than those who did not present with progressive pain ( $p < 0.05$ ). Patients with motor grade 0, I, II, III, IV, V, the good outcome were 16.7, 42.9, 60, 87.5, 100 and 100 percents, respectively. Overall, the good outcome was 58.5 percent. The motor grade was significantly related to the outcome ( $p < 0.001$ ). The proprioceptive impairment was found in 51.2 percent. Patients with intact proprioception had good outcome, significantly higher than those with impaired proprioception ( $p < 0.001$ ). The anal sphincter tone was normally found in 51.2 percent of the patients. The patients who had normal anal sphincter tone had the good outcome, significantly higher than the patients who had decreased tone ( $p < 0.001$ ).

**Conclusion** : The predicting factors of the outcome of the spinal cord compression from extradural metastases after surgery is the neurological status at the time of treatment. In this study, it was found that both proprioception and anal sphincter tone were able factors to predict the surgical outcome.

**Key words** : Spinal cord compression, Extradural metastases, Surgery.

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**เหตุผลของการทำวิจัย** : ไขสันหลังถูกกดทับจากมะเร็งกระจายมายังนอกชั้นเยื่อหุ้มไขสันหลังเป็นภาวะแทรกซ้อนทางระบบประสาทที่พบบ่อยที่สุดในผู้ป่วยมะเร็ง ถ้าไม่รักษา ไขสันหลังจะถูกกดทับมากขึ้น ทำให้เป็นอัมพาต สูญเสียความรู้สึก และการทำงานของกล้ามเนื้อหูรูด การวินิจฉัยแต่เนิ่น ๆ และการรักษาที่เหมาะสมจะมีผลสำคัญต่อคุณภาพชีวิต การรักษามีทั้งการผ่าตัด การฉายแสง และการรักษาาร่วมกัน การเลือกผู้ป่วยที่เหมาะสมจะทำให้เพิ่มความสำเร็จในการรักษาและลดอัตราการเกิดโรคแทรกซ้อนและอัตราการตายได้

**วัตถุประสงค์** : เพื่อที่จะหาตัวบ่งชี้ผลการรักษาของผู้ป่วยไขสันหลังถูกกดทับจากมะเร็งกระจายมายังนอกชั้นเยื่อหุ้มไขสันหลังที่ได้รับการผ่าตัด

**สถานที่ที่ทำการศึกษา** : หน่วยประสาทศัลยศาสตร์ ภาควิชาศัลยศาสตร์ คณะแพทยศาสตร์ จุฬาลงกรณ์มหาวิทยาลัย

**รูปแบบการวิจัย** : การวิจัยย้อนหลัง

**ผู้ป่วยที่ได้ทำการศึกษา** : ผู้ป่วยไขสันหลังถูกกดทับจากมะเร็งกระจายมายังนอกชั้นเยื่อหุ้มไขสันหลังที่ได้รับการผ่าตัดในโรงพยาบาลจุฬาลงกรณ์ ตั้งแต่เดือนมกราคม พ.ศ. 2536 ถึงเดือนธันวาคม พ.ศ. 2543 จำนวน 41 ราย

**วิธีการศึกษา** : เก็บข้อมูลจากสมุดประวัติการรักษา เวชระเบียน ฟิล์ม และสัมภาษณ์ผู้ป่วยหรือญาติทางโทรศัพท์

**ผลการศึกษา** : ผู้ป่วยทั้งหมด 41 คน เป็นชาย 22 คน และหญิง 19 คน อายุเฉลี่ย 53.3 ปี สาเหตุที่พบบ่อยในเพศชายคือมะเร็งปอด และในเพศหญิงคือมะเร็งเต้านม ตำแหน่งที่พบบ่อยคือกระดูกสันหลังระดับอก ผู้ป่วยมาด้วยอาการปวดเป็นอาการเริ่มแรก 68.3 เปอร์เซ็นต์ ผู้ป่วยที่มาด้วยอาการปวดเป็นอาการเริ่มแรกหลังผ่าตัดสามารถเดินได้โดยมีหรือไม่มีผู้ป่วยหรือเครื่องช่วยได้มากกว่าผู้ป่วยที่ไม่ได้มาด้วยอาการปวดเป็นอาการแรกอย่างมีนัยสำคัญทางสถิติ ( $p < 0.05$ ) ผู้ป่วยที่มีการทำงานของกล้ามเนื้อเกรด 0, I, II, III, IV, V สามารถเดินได้ 16.7, 42.9, 60, 87.5, 100, 100 เปอร์เซ็นต์ ตามลำดับ

สรุป

:

เกรดการทำงานของกล้ามเนื้อสัมพันธ์กับการเดินได้ของผู้ป่วยอย่างมีนัยสำคัญทางสถิติ ( $p < 0.001$ ) มีการสูญเสียการรับรู้เกี่ยวกับปฏิกิริยา 51.2 เปอร์เซ็นต์ และมีความสัมพันธ์กับการเดินได้อย่างมีนัยสำคัญทางสถิติ ( $p < 0.001$ ) มีความตึงของกล้ามเนื้อหูรูดทวารหนักปกติ 51.2 เปอร์เซ็นต์ และมีความสัมพันธ์กับการเดินได้อย่างมีนัยสำคัญทางสถิติ ( $p < 0.001$ )

ตัวบ่งชี้ผลการรักษาของผู้ป่วยไขสันหลังที่ถูกกดทับจากมะเร็งกระจายมายังนอกชั้นเยื่อหุ้มไขสันหลังที่ได้รับการผ่าตัดคือสภาพทางระบบประสาทก่อนการผ่าตัด การศึกษานี้พบว่าการรับรู้เกี่ยวกับปฏิกิริยาและความตึงของกล้ามเนื้อหูรูดทวารหนักสามารถเป็นตัวบ่งชี้ผลการรักษาได้

Despite remarkable accomplishments in the treatment of cancer during the past decades, the major cause of death in most patients remains metastatic disease and its complications. Spinal cord compression from extradural metastases (SCCEM) is relatively a common complication of cancer: nearly five percent of complications manifested in the central nervous system.<sup>(1,2)</sup> However, more recent studies suggested that 1 out of 3 patients diagnosed with cancer might have metastases to the spine.<sup>(3)</sup> The axial skeleton was the third most common site of metastases after the lungs and the liver. If untreated, the SCCEM inexorably progressed, causing paralysis, sensory loss and sphincter incontinence.<sup>(4)</sup> Early diagnosis was crucial and effective treatment normally had a major impact on the quality of life of the patients. Palliative treatment aimed at preserving or restoring spinal cord function markedly ambulation and continence or alleviating intractable pain was warranted in many cases.<sup>(5)</sup> The treatments were operation and radiotherapy, either alone or in combination. The surgical morbidity defined as deterioration in the preoperative neurological grade was 12 percent and the mortality rate was 9 percent. It is possible to increase the success rate and decrease the surgical morbidity and mortality by improving the selection criteria of surgical candidates.<sup>(6)</sup> The aim of this article was to identify the predicting factors for the outcome of the SCCEM after an operation.

### Materials and Methods

The medical records of forty-one patients with the diagnosis of the SCCEM, confirmed by spinal MRI and histopathological results and operated at King

Chulalongkorn Memorial Hospital from January 1993 to December 2000. In each case the pertinent information were collected includes: 1) sex, 2) age, 3) initial symptom and duration of preoperative symptom, 4) preoperative neurological status, including motor, pain and proprioception, reflex, anal sphincter tone, 5) the American Society of Anesthesiologists (ASA) physical status, 6) site of spinal cord compression, 7) type and duration of an operation, 8) other treatment including steroid, radiotherapy or rehabilitation, 9) histopathological diagnosis.

In the assessment of the outcome, patients were classified as good or poor outcome. Patients were considered to have good outcome if they could ambulate with or without assistance or assisting instrument within 1 year after the operation.

Uni-variate analysis by  $\chi^2$  test or student's t-test and logistic regression were employed to analyze the effects of several variables influencing the outcomes.

### Results

A total number of 41 patients who underwent operation for the SCCEM during the review period. There were 22 male and 19 female patients. (Table 1) The majority of the male were between the age of 51 to 70 years, and the female, 41 to 60 years. (Figure 1)

**Table 1.** Show relation between the sex and the outcome.

|              | Good | Poor | Total |
|--------------|------|------|-------|
| Male         | 13   | 9    | 22    |
| Female       | 11   | 8    | 19    |
| <b>Total</b> | 24   | 17   | 41    |

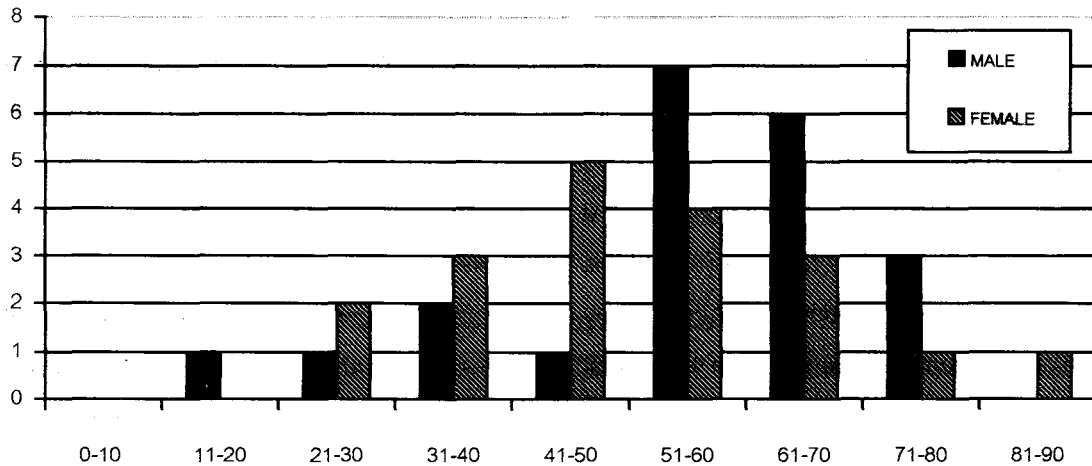


Figure 1. Show the number of patients related to the sexes and the ages.

The average age was 53.34 years; male, 56.05 years; female, 50.21 years. Neither the age nor sex of the patients appeared to be significantly related to the outcome of the surgery.

The causes of the SCCEM are in Table 2. The most common cause in male was lung cancer; in female, breast cancer. The compression was located at the thoracic level 65.85 percent, cervical 21.95 percent and lumbar 12.20 percent. (Figure 2)

Table 2. Show primary site of the metastatic tumor.

| Male              | Number | Female       | Number |
|-------------------|--------|--------------|--------|
| Neck              | 1      | Thyroid      | 3      |
| Lung              | 3      | Breast       | 5      |
| GI                | 1      | GI           | 3      |
| Kidney            | 1      | Cervix       | 2      |
| Prostate          | 1      | Sarcoma      | 1      |
| Rhaphdomyosarcoma | 1      | Lymphoma     | 1      |
| Liposarcoma       | 1      | Plasmacytoma | 1      |
| Sarcoma           | 2      | Unknown      | 3      |
| Lymphoma          | 1      |              |        |
| Plasmacytoma      | 2      |              |        |
| Multiple myeloma  | 1      |              |        |
| Unknown           | 7      |              |        |

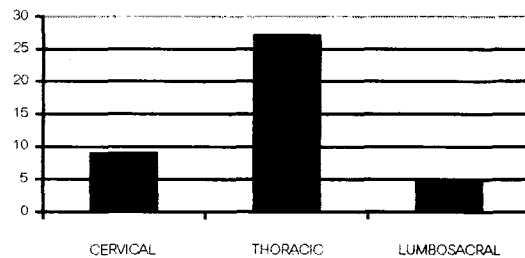


Figure 2. Show the number of patients and level of tumor.

Twenty-eight patients (68.3 %), described their initial symptom of the SCCEM as progressive pain. Those who presented with progressive pain as an initial symptom have the good outcome, significantly higher than those who did not present with progressive pain ( $p < 0.05$ , odd ratio 5.6). (Table 3) Fifteen patients (36.6 %) presented with autonomic dysfunction which was found not significantly related to the outcome. (Table 4)

Table 3. Show relation between the initial symptom and the outcome.

|              | Good      | Poor      | Total     |
|--------------|-----------|-----------|-----------|
| Pain         | 20        | 8         | 28        |
| No pain      | 4         | 9         | 13        |
| <b>Total</b> | <b>24</b> | <b>17</b> | <b>41</b> |

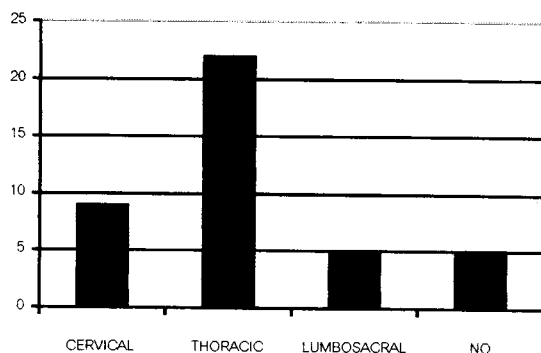
**Table 4.** Show relation between the symptom with autonomic dysfunction and the outcome.

|                           | Good | Poor | Total |
|---------------------------|------|------|-------|
| Autonomic dysfunction     | 9    | 6    | 15    |
| Normal autonomic function | 15   | 11   | 26    |
| <b>Total</b>              | 24   | 17   | 41    |

Motor grades were classified in 0-V and the outcomes were shown in Table 5. Among the patients with motor grade 0, I, II, III, IV, V, the good outcome were 16.7, 42.9, 60, 87.5, 100, 100 percents, respectively. Overall the good outcome was 58.5 percent. The motor grade was significantly related to the outcome. ( $p < 0.001$ )

**Table 5.** Show relation between the motor grade and the outcome.

|              | Good | Poor | Total |
|--------------|------|------|-------|
| Grade O      | 2    | 10   | 12    |
| Grade I      | 3    | 4    | 7     |
| Grade II     | 3    | 2    | 5     |
| Grade III    | 7    | 1    | 8     |
| Grade IV     | 7    | 0    | 7     |
| Grade V      | 2    | 0    | 2     |
| <b>Total</b> | 24   | 17   | 41    |



**Figure 3.** Show the number of patients and the level of sensory impairment.

The sensory impairment was most commonly found at the thoracic level and was not related to the outcome. (Figure 3) The proprioceptive impairment was found in 51.2 percent of the patients. The patients who had good proprioception had good outcome, significantly higher than those who had impaired proprioception ( $p < 0.001$ , odd ratio 60.8). (Table 6)

Anal sphincter tone was found normal in 51.2 percent of the patients. They had had good outcome, significantly higher than the patients with decreased tone ( $p < 0.001$ , odd ratio 28.5). (Table 7)

The general condition of the patient was graded according to their physical status, as classified by the American Society of Anesthesiologists (ASA). The physical status of the patients was graded in ASA II in 34.15 percent, and ASA grade IIE in 29.27 percent of the patients. They were found not significantly related to the outcome. (Table 8)

**Table 6.** Show relation between the proprioception and the outcome.

|                         | Good | Poor | Total |
|-------------------------|------|------|-------|
| Intact proprioception   | 19   | 1    | 20    |
| Impaired proprioception | 5    | 16   | 21    |
| <b>Total</b>            | 24   | 17   | 41    |

**Table 7.** Show relation between the anal sphincter tone and the outcome.

|                               | Good | Poor | Total |
|-------------------------------|------|------|-------|
| Normal anal sphincter tone    | 19   | 2    | 21    |
| Decreased anal sphincter tone | 5    | 15   | 20    |
| <b>Total</b>                  | 24   | 17   | 41    |



**Table 8.** Show the numbers of patients and ASA physical status.

|     | Emergency | Non emergency |
|-----|-----------|---------------|
| I   | 7         | 5             |
| II  | 12        | 14            |
| III | 1         | 2             |
| IV  | 0         | 0             |

The most common operation was laminectomy and decompression, 78.05 percent (32/41). The other was anterior decompression. The average time of operation was 3.15 hours.

The patients were treated with dexamethasone, 75.6 percent (31/41). Dosage and duration of dexamethasone administration during the study varied and most dosage was 20 mg/day divided 4 times daily. Patients were treated with radiotherapy, 85.4 percent (35/41). The doses of radiotherapy given, as well as the rate of its administration, varied greatly over the period of study, such that the therapeutic effect of the irradiation itself could not be accurately ascertained, 92.7 percent (38/41) of the patients required rehabilitation. There was no significant difference in the treatment with dexamethasone, radiotherapy and rehabilitation.

After logistic regression, forward stepwise, there were two factors that could predict the outcome: proprioception and anal sphincter tone. (Table 9)

**Table 9.** Show the factors after logistic regression.

|                     | P value | Adjusted odd ratio |
|---------------------|---------|--------------------|
| Proprioception      | 0.003   | 70.901             |
| Anal sphincter tone | 0.007   | 33.636             |

## Discussion

A review of the recent literatures showed controversy over the optimum management of the patients with the SCCEM. Some literatures indicated that the most important single factor determining prognosis was the level of neurological function at the beginning of therapy.<sup>(1,4,7)</sup> But some literatures indicated that several factors were related to the outcome, namely: 1) tumor biology, 2) completeness of the myelographic block, 3) location of tumor within the spinal canal, 4) progressive rate of neurological symptoms, 5) general medical status of the patient, and 6) type of surgery.<sup>(8-10)</sup> Therefore, there were no definite factors that could predict the outcome of the patients after their surgery. This study evaluated several factors that might be related to the outcome. There were four factors that were related to the outcome: 1) motor grading, 2) proprioception, 3) anal sphincter tone, 4) progressive pain as initial symptom.

The initial symptom was progressive axial, referred or radicular pain that might last for days to months. It was 68.3 percent. According to Gilbert *et al.*, it was approximately 95 percent.<sup>(11)</sup> In this study, however, the patients who presented with progressive pain as an initial symptom had better outcome than those who did not present with progressive pain.

If the motor grade was less than II, the good outcome was less than 50 percent. But if Motor grade was II or higher, the good outcome became reversed and more than 50 percent. There were some literatures which suggested that the motor grade should be a predicting factor of the outcome.<sup>(12,13)</sup>

The proprioceptive impairment was found in 51.2 percent of the patients. The patients with good proprioception had better outcome than those who

had impaired proprioception. There was a literature which suggested that the motor grade should be a predicting factor of the outcome.<sup>(12)</sup>

The anal sphincter tone was found normal in 51.2 percent of the patients. Those who had normal anal sphincter tone had better outcome than those who had decreased tone. Gilbert *et al.* presented that sphincter loss of more than one day was a factor of poor prognosis.<sup>(12)</sup>

The most common cause and location were similar among the literatures.<sup>(11,14,15)</sup> The most common cause of the SCCEM was lung cancer in male and breast cancer in female. The most common location was the thoracic level.

Both proprioception and anal sphincter tone could predict the outcome. This was the first study to show that both were predicting factors of the outcome of the SCCEM after surgery.

### Conclusions

The predicting factor of the outcome of the spinal cord compression from extradural metastases after surgery is the neurological status at the time of treatment. In the study, both proprioception and anal sphincter tone were reliable to predict the outcome. Current results are able to improve by early diagnosis and accurate selection of patients who received either surgery or conservative treatment. But this study was a retrospective analysis and the numbers of patients was not too many. It needed more patients and prospective analysis.

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