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Case study

The significance of spinal fixation in palliative surgery for spinal metastases

Shurei Sugita *, Takahiro Hozumi, Kiyofumi Yamakawa, Takahiro Goto

Department of Orthopaedic Surgery and Musculoskeletal Oncology, Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital, Tokyo, Japan

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ABSTRACT

The purpose of this study is to assess appropriate fixation methods for surgical spinal stabilization for spinal metastases. 191 patients who underwent spine surgery for spinal metastases are included in this study. The surgeries included 1) posterior decompression only (29), 2) posterior decompression and fixation (153), and 3) decompression and circumferential fixation (9). We evaluated and compared all cases based upon 1) use of fixation, 2) number of levels included in the fixation, 3) type of fixation, 4) use of bone graft, 5) presence of preoperative collapse of involved vertebrae, and 6) involved area of vertebrae according to Kostuik classification. Progression of vertebral collapse on radiographs or Magnetic Resonance Imaging (MRI) or occurrence of implant failure after surgery was considered a failed case. The number of failed cases was 51 (27%). The factors that were compared between the failed and successful groups were: use of fixation ($p < .01$), extent of fixation (one level above and one level below affected vertebrae vs. $\geqq$ two above and two below, $p < .01$), presence of preoperative collapse of affected vertebrae ($p < .05$), and $\geqq$ four of six columns of vertebral involvement according to Kostuik classification ($p < .01$). All results were statistically significant. In conclusion, when treating metastatic spinal disease with instability, it is recommended that posterior fixation with instrumentation be used and extend at least two levels above and two below the affected vertebrae. Preoperative collapse of affected vertebrae and greater involvement of the vertebrae with metastatic disease results in greater local instability.

1. Introduction

Metastatic spinal disease is a clinically challenging condition, affecting approximately 30% of all cancer patients [1,2]. Of those who develop metastases to the spine, 5–10% of cancer patients develop symptoms during their clinical course [3,4]. The natural course of patients with metastatic spinal disease is unfavorable [5]. Untreated patients can become para- or tetraplegic, which results in a large clinical burden on the healthcare system. These conditions are expected to increase in number due to longer life expectancy as a result of continuing advances in oncological therapy.

The goals of treatment for spinal metastases are to 1) decompress the spinal cord to avert spinal paralysis, 2) restore stability to the spine, and 3) prevent local recurrence of the tumor. To accomplish these goals, we first perform conventional posterior decompression. To reconstruct and stabilize the anterior column of the affected vertebrae, the proper method and extent of posterior fixation to provide adequate spinal stability must be appropriately selected.

The goal of this study is to outline the appropriate posterior fixation method (device, extent) for metastatic spinal disease, using retrospective radiographic data from patients with metastatic spinal disease from our hospital.

2. Materials and methods

2.1. Patients

Three hundred-thirteen patients who underwent spinal surgery due to spinal metastases from 1992 to 2008 were considered for inclusion in this study. One hundred ninety-one patients had postoperative magnetic resonance imaging (MRI) studies available for review and were included in this study. Patients' characteristics are described in Table 1. The surgical procedures consisted of 1) posterior decompression only (29 patients), 2) posterior decompression and fixation with instrumentation (153 patients), and 3) circumferential decompression and fixation (9 patients). The choice of surgical approach was the individual surgeon's decision

* Corresponding author at: Department of Orthopaedic Surgery, Tokyo Metropolitan Cancer and Infectious Diseases Center Komagome Hospital, 3-18-22, Honkomagome, Bunkyo-ku, Tokyo 113-8677, Japan.
E-mail address: ssugita-tky@umin.ac.jp (S. Sugita).

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Table 1
Demographic data of patients included in this study.

Age (year) (IQR)	63 (54–70)
Observation period (month) (IQR)	9.9 (5.7–20.6)
Metastatic spine level (cases)	
Cervical	18
Cervical-thoracic	19
Thoracic	105
Thoraco-lumbar	18
Lumbar	30
Sacrum	1
Origin of metastases (cases)	
Malignant lymphoma	7
Hepato cellular carcinoma	11
Thyroid cancer	32
Utrerocervical cancer	6
Esophagus cancer	2
Renal cell carcinoma	25
Prostate cancer	13
Multiple myeloma	6
Colon cancer	17
Breast cancer	32
Lung cancer	20
Pancreatic cancer	2
Others	18

based of the patient's clinical status. The clinical status was for example, affected site (cervical, thoracic, lumbar), the number of affected spine levels, and the type of metastases (osteoblastic or osteolytic).

The median patient follow-up period was 9.9 months (IQR 5.7-20.6). All patients were followed radiographically by plain X-ray and by MRI to assess for any change in spinal alignment postoperatively. We defined the progression of vertebral collapse or the occurrence of instrumentation failure (breakage of the rod, or loosening of pedicle screw, or back out of the hook) on follow-up-imaging as a failed case.

We compared the failed cases to the successful cases based on the following criteria 1) use of fixation, 2) number of levels included in the fixation, 3) type of fixation (pedicle screw or hook), 4) use of bone graft, 5) presence of preoperative collapse of affected vertebrae, and 6) involved areas of vertebrae according to the Kostuik classification [6]. To assess the effect of fixation extent, we further divided the patients into sub groups as follows: A) one level above and one below affected vertebrae (or either one may two levels), B) two levels above and two below, C) more than two levels above and below, and D) circumferential fixation.

2.2. Statistical analysis

The statistical analyses were performed using the JMP® 11 software program (SAS, Cary, NC) Descriptive statistics were used to analyze the clinical information, demographic factors and other test data. Continuous variables are expressed as the median and interquartile range (IQR). Differences between the two groups were examined using the Mann–Whitney *U* test for continuous variables or the chi-square test for categorical data, when appropriate. A p-value <.05 was considered statistically significant.

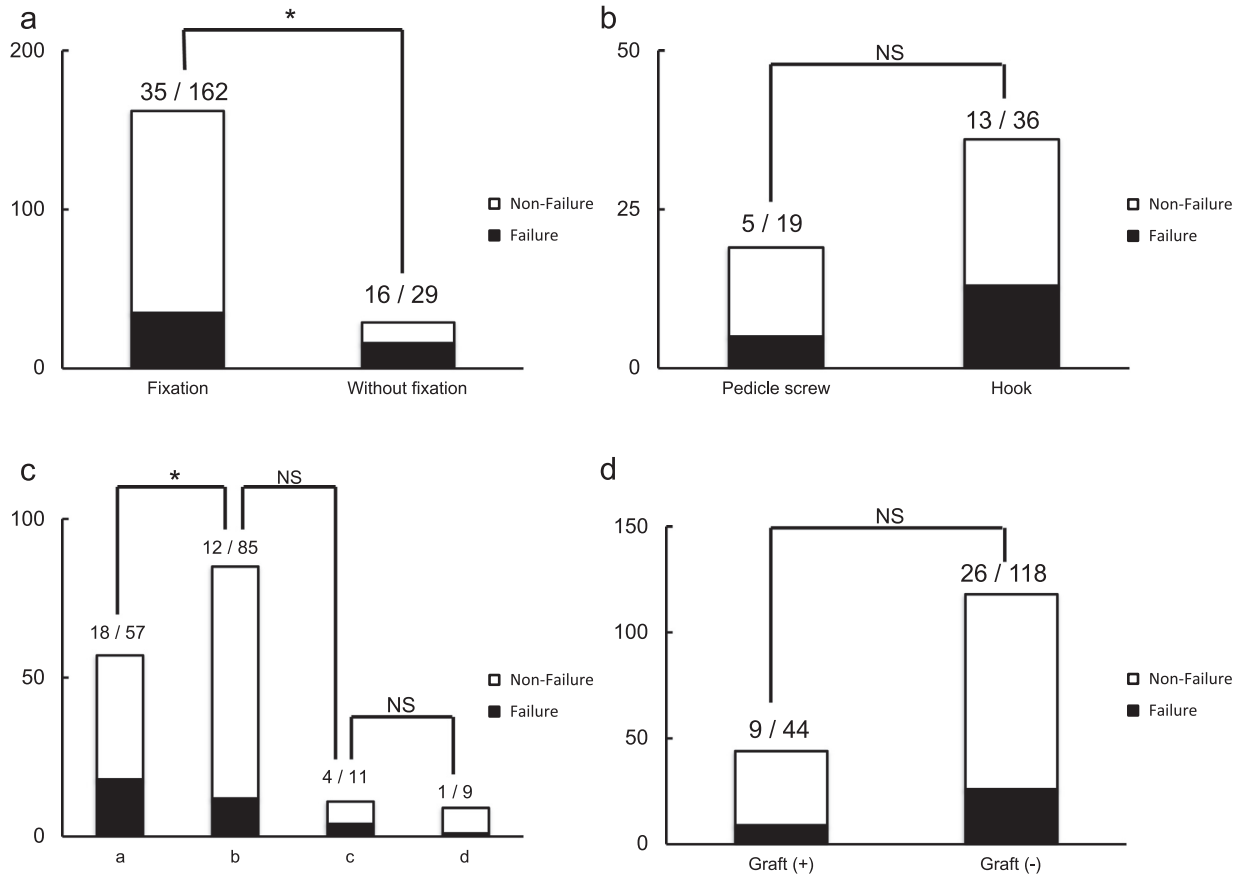

Fig. 1. Comparison of failed cases (black) and non-failed cases (white) considering fixation method. Numbers on the bar represent failed cases/total cases. Percentage of failed cases was analyzed statistically. *Indicates statistical significance (P < .05). NS indicates for no statistical significant significance. (a) Comparison between fixation and no fixation groups (b) comparison between pedicle screw and hook fixation (c) comparison between fixation extent group (d) comparison between using bone graft and without graft.