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SPINAL DEFORMITY FOLLOWING LAMINECTOMY FOR SPINAL CORD TUMORS IN CHILDREN

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ABSTRACT

Purpose: The purpose of this study was to determine which led to spinal deformity in children with spinal cord tumors.

Material and methods: 164 consecutive children (<21 years old) underwent laminectomy for intramedullary spinal cord tumor resection at NYU Medical Center. Of these patients, 43 required spinal stabilization for progressive deformity. Complete neurosurgical records were available for 38 patients. Case records of all 164 children were retrospectively examined for factors that may contribute to or predict postoperative spinal deformity.

Results: There was a statistically significant difference in age at time of first tumor operation, with the stabilized cohort undergoing surgery at a younger age (7.2 yrs) compared to the nonstabilized cohort (9.4 yrs). There was no statistically significant difference between the two groups with regards to sex. Patients with tumors involving the thoracic spinal cord or conus were statistically more likely to require eventual spinal stabilization than those involving the cervical spinal cord. Tumor related cysts and lack of MR gadolinium enhancement also correlated with eventual need for spinal stabilization. Tumor span did not predict eventual spinal deformity requiring stabilization.

Conclusions: We have determined several factors which predispose children to deformity following surgery for intramedullary tumors.

Key words: deformity, scoliosis, spine, stabilization, tumor

INTRODUCTION

Laminectomy is the most commonly used surgical technique for exposure and decompression of the spinal neural elements. Operations involving multilevel laminectomies have been correlated with postoperative spinal deformity. Children are especially prone to develop postoperative deformity. Patient age, number and location of involved vertebral levels, extent of bone removal, facet injury, and adjuvant radiation have been hypothesized to contribute to postoperative deformity. However, a lack of large patient series has prohibited conclusions regarding which factors are important. In this study we report a large series of children who underwent laminectomy for a single diagnosis, intramedullary spinal cord tumor. Our intent was to determine factors which predispose to the development of spinal deformity.

MATERIALS AND METHODS

Between 1980 and 1994, 164 consecutive children (<21 years old) underwent laminectomy for intramedullary spinal cord tumor resection at NYU Medical Center. Of these patients, 43 required spinal stabilization for progressive deformity. These patients form the basis of this study. Complete neurosurgical records were available for 38 patients. Case records of all 164 children were retrospectively examined for factors that may con-

tribute to or predict postoperative spinal deformity: age, deformity upon presentation, pre- and postoperative neurological function (graded according to the modified McCormick scale), tumor histology and configuration, operative technique, and adjuvant therapy. Long-term follow-up was obtained via telephone interview to assess functional outcome. Statistical comparison of the non-stabilized and stabilized cohorts was carried out.

RESULTS

Patient Characteristics

Patient age and sex for both stabilized and non-stabilized patients are presented in Table 1. No patients in the stabilized group had a coexisting diagnosis of neurofibromatosis. Patients in the stabilized group were diagnosed with intramedullary spinal cord tumor at a younger age (7 yrs) than the nonstabilized group (9 yrs) although this difference did not reach statistical significance ($p=0.056$). There was a statistically significant difference in age at time of first tumor operation, with the stabilized cohort undergoing surgery at a younger age (7.2 yrs) compared to the nonstabilized cohort (9.4 yrs). There was no statistically significant difference between the two groups with regards to sex.

Preoperative Clinical Status

Patients with spinal deformity upon presenta-

tion were more likely (58%) than patients without presenting deformity (26%) to require eventual spinal stabilization. There was no significant difference between the stabilized and non-stabilized patients with regards to preoperative functional grade.

Radiological Evaluation and Tumor Configuration

Diagnoses of intramedullary spinal cord tumor were made on the basis of MRI (110 patients, 67%) or, prior to 1987, CT myelography (54 patients, 33%). Information regarding tumor site, span, and appearance is presented in Table 2. Patients with tumors involving the thoracic spinal cord or conus were statistically more likely to require eventual spinal stabilization than those involving the cervical spinal cord. Tumor related cysts and lack of MR gadolinium enhancement also correlated with eventual need for spinal stabilization. Tumor span did not predict eventual spinal deformity requiring stabilization.

Tumor Surgery

All children underwent total laminectomy for tumor exploration. A small number of patients (<15%) had the lamina replaced as an osteoplastic flap. A large number of patients in both cohorts underwent laminectomy for tumor exploration prior to presentation to NYU. However no tumor operation, whether performed at an outside institution or performed by the senior author, was noted to involve disruption of the facets. Information regarding operative technique for tumor exploration is given in Table 3. Patients requiring eventual spinal stabilization underwent more tumor operations (avg 2.44 per patient) and were more likely to have undergone gross total resection (93%) than patients not requiring eventual stabilization (1.85 and 78%, respectively). There was no statistical difference between the patient cohorts with regards to number of laminectomy levels nor site of laminectomy.

Adjuvant Therapy

The majority of patients received adjuvant radiation or chemotherapy (Table 4). Significantly more patients in the stabilized group received radiation therapy (72%) as compared to the non-stabilized group (44%). There was no difference between both patient populations in regards to adjuvant chemotherapy.

Functional Grade at Most Recent Follow-up

Seventy percent (116 of 164) of the patients were available for long term follow-up. Mean follow-up time per patient was 8.5 years. Children who required underwent spinal stabilization were more likely to have a worse functional outcome, with 42% being plegic at most recent follow-up. This contrasts to the majority (71%) of non-stabilized patients who had either mild or no neurological deficit.

DISCUSSION

Scoliosis and kyphosis may evolve following

laminectomy [1-3]. Many children, approximately two-thirds, developed a spinal deformity following laminectomy for their intramedullary neoplasm. However, only one-third of these children required a stabilization procedure, either anterior, posterior or combined approach. The only significant factors associated with progressive deformity were cystic tumors and prior radiotherapy. Spinal deformity has been reported as a complication of radiation therapy used to treat epidural tumors [4,5]. Other parameters such as location, histology and age were not significantly associated with occurrence of spinal deformity. The mean time to stabilization procedure was 3.4 years. In one study of 58 patients younger than 25 years who underwent laminectomies for intraspinal tumors, deformity occurred in 46% of patients younger than 15 years and in only 6% of patients older than 15. In addition there was a higher incidence for a progressive deformity in the cervical region [6]. Several authors have recommended osteoplastic laminotomies for all children to reduce the incidence of spinal deformity [7,8].

From our large experience with intramedullary spinal cord tumors, it is essential that patients with intramedullary neoplasms be followed for possible progression of spinal deformity. All patients should undergo routine serial plain radiographs. We recommend a preoperative x-ray for all children and serial films for children with significant risk for progressive deformity.

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