Return to Play for Neurosurgical Patients

Rajiv Saigal[1], H. Hunt Batjer[2], Richard G. Ellenbogen[3], Mitchel S. Berger[1]

Key words

- Athlete
- Craniotomy
- Neurosurgical lesion
- Return to play
- Spine instrumentation
- Sports
- Survey

From the [1]Department of Neurological Surgery, University of California, San Francisco, San Francisco, California, USA; [2]Department of Neurological Surgery, University of Texas, Southwestern Medical Center, Dallas, Texas, USA; and [3]Department of Neurological Surgery, University of Washington, Seattle, Washington, USA

To whom correspondence should be addressed: Rajiv Saigal, M.D., Ph.D. [E-mail: saigalr@neurosurg.ucsf.edu]

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BACKGROUND: **Concussion and sports-related cranial and spine injuries recently have garnered increased attention from the media, public, and sports' governing bodies. Although concussion has been well-studied, there are minimal data on return to play for structural neurosurgical lesions.**

OBJECTIVE: **We aimed to study current neurosurgical practice on return to play for structural neurosurgical lesions in order to eventually establish guidelines for these athletes.**

METHODS: **A survey was sent to all American Association of Neurological Surgeons members inviting them to submit information on athletes who presented with structural neurosurgical lesions. These included both operative and nonoperative lesions. Ten examples of relevant clinical scenarios were included. Neurosurgeons were surveyed about their practice of clearing these patients for return to play and about patient outcomes afterwards, including any clinical sequelae. Responses were tabulated and studied to search for trends in current practice. Nonstructural cases, such as concussion and cervical strain cases, were excluded. The Mann-Whitney *U* test was used to test for statistical difference in the time to return for spine versus cranial, instrumented versus noninstrumented spine, and pediatric versus adult cases.**

RESULTS: **Ninety-eight respondents entered data on a total of 189 patients (118 surgical and 71 nonoperative/incidental). In the surgical category, 109 cases (41 cranial, 67 spine, and 1 peripheral nerve lesions) met inclusion criteria. There was a significant difference in time to return between spine (88% returned ≤6 months) versus cranial (50% returned >6 months, $P < 0.001$), noninstrumented (55% returned ≤3 months) versus instrumented spine (92% returned >3 months, $P = 0.001$), and adult (78% returned ≤6 months) versus pediatric cases (52% returned >6 months, $P = 0.021$). Fifty nonoperative/incidental cases met inclusion criteria; 94% of athletes returning to play with nonoperative lesions had no reported clinical sequelae. All nonsurgical and 81% of surgical respondents required deficit resolution before return to play.**

CONCLUSIONS: **The results presented here are the first effort to study current practice on return to play for structural neurosurgical lesions. They establish an early foundation for neurosurgical guidelines on these patients.**

INTRODUCTION

Concussion and sports-related cranial and spine injuries are topics at the forefront of discussion and debate. With increased attention from the media, public, and sports' governing bodies, there is a need for neurosurgeons to better understand these injuries and their impact on those participating in sports. Guidelines have been suggested for certain specific types of injuries. Much attention has focused on return to play after concussion (11) but less to structural neurosurgical lesions (14).

For structural lesions, there are scattered case reports with a paucity of established guidelines. In patients with arachnoid cysts, a few case reports have demonstrated the risk of traumatic hemorrhage during participation in athletics (10, 16, 19, 21). For cervical spine injuries, some suggest lack of further symptoms, full range of motion, and full strength before return to play (4). Congenital malformations such as Chiari malformations are cause for concern when associated with symptomatic syrinx or brainstem mass effect (3, 14, 15). One study presented a small group of patients who safely returned to play after craniotomy (14).

There has been one survey-based study of pediatric neurosurgeon experience with shunted hydrocephalus patients (2). Seventy-seven percent of respondents had never observed an athletic-related complication (2). Shunt dysfunction and fractured catheters were the most common complication seen by the remaining 23%. Participation in noncontact sports was allowed by 90%. Pediatric neurosurgeons split roughly equally between allowing participation in all contact sports, a restricted subset, or no contact sports.

There are few universally accepted guidelines for return to play in neurosurgical patients, and the clinician is left to formulate his/her own guidelines largely

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from personal experience. We aimed to collate and study these personal experiences to eventually establish guidelines for safe return to play in athletes with structural neurosurgical lesions.

METHODS

An e-mail was sent to all 6793 American Association of Neurological Surgeons attending neurosurgeons, inviting them to submit information on athletes who presented with neurosurgical lesions. These included both operative and nonoperative lesions. An online survey was used to collect data. Ten examples were given of postoperative lesions of interest. Survey participants were invited to respond to 13 questions on surgical lesions and 4 questions on incidental and nonsurgical lesions (**Supplementary Material**). Neurosurgeons were surveyed about their practice of clearing these patients for return to play and about patient outcomes afterwards, including any clinical sequelae. Responses were tabulated and studied to search for trends in current practice. Data were collected from September to November 2012.

Responses with insufficient data for study were excluded. Nonoperative cases incorrectly submitted under the operative section were moved to the correct category (nonoperative) for analysis. Cases of concussion and cervical strain were excluded unless there was an associated radiographic lesion. Data were analyzed in Excel (Microsoft, Redmond, Washington, USA) and statistics were computed in SPSS 21 (IBM, Armonk, New York, USA). To compare the number of patients allowed versus not allowed to return to play, we formed contingency tables and performed χ^2 analysis. For tables with expected values less than 5, the Fisher exact test was substituted for the Pearson χ^2 test. For categorical variables with multiple groups (e.g., sport) with expected values less than 5, groups with smaller sample size were combined to allow for statistical analysis via χ^2 or Fisher exact test. If the patient was not allowed to return to his or her initial sport, the patient was considered to not return, even if allowed to participate in other athletic activities.

In patients returning to play, the Mann-Whitney U test was used to test for difference in time to return for dichotomous categorical variables (cranial vs. spine, instrumented vs. noninstrumented spine, and pediatric vs. adult). The Kruskal-Wallis test was used to compare time to return for categorical variables with more than 2 groups. For each of the 3 tests, the null hypothesis was that the distribution of time to return to play was the same between the designated groups. The alternative hypothesis was that there was a difference in time to return between the groups. *P*-values for 2-tailed tests were calculated with significance level set to $\alpha = 0.05$.

RESULTS

Ninety-eight neurosurgeons responded to the survey, inputting information on a total of 189 patients (118 surgical and 71 nonoperative/incidental). Insufficient data were entered by 7 respondents for the surgical query and 3 respondents to the nonsurgical query. These responses were excluded. Additional case exclusions are discussed herein.

Operative Neurosurgical Lesions

Sixty-four percent (n = 63) of participating neurosurgeons operated on an athlete and then gave guidance on return to play. Surgical patient ages ranged from 10 to 42. A total of 41 cranial cases, 67 spine cases, and 1 peripheral nerve case were submitted (**Figure 1**). 82% of athletes were male and 18% were female. Three cases of concussion and one case of cervical strain were submitted, although nonoperative, and were excluded from analysis. Spine lesions constituted 61% of the surgical lesions, with a preponderance of herniated discs. Patients participated in a variety of sports (**Figure 1**), including football (n = 32), soccer (n = 14), baseball or softball (n = 11), basketball (n = 12), martial arts (n = 5), tennis (n = 5), track and field (n = 5), hockey (n = 2), volleyball (n = 3), wrestling (n = 4), and other (n = 15).

Postoperative patients had a wide range of neurological symptoms and signs, ranging from pain to focal weakness to expressive aphasia. Eighty-one percent of neurosurgeons (n = 44) required deficits to resolve before return to play. Nineteen percent (n = 10) did not require deficits to resolve; however, of the cases submitted by the group not requiring deficit resolution, pain frequently was present, but there was only one report of a neurological deficit (i.e., cranial nerve deficit, focal weakness, or numbness). This one case was a 16-year-old male patient with a spontaneous cervical epidural hematoma who underwent a cervical laminectomy. He had mild residual hand weakness and was allowed to return to athletic play after the findings of his neurological examination were stable at 1 year. Thus, although some athletes were allowed to return to play with persistent pain, there were almost no cases of allowing an athlete with persistent cranial nerve deficit, weakness, or numbness to return.

Comparing cranial and spine patients, we found no significant difference in the number who returned to play (P = 0.19, Pearson χ^2), but there was a significant time difference for those allowed to return (P = 0.001, Mann-Whitney U). A total of 80% of cranial and 89% of spine patients returned to play. For cranial patients, 0% returned to play at 0–1 month (n = 0), 16% at 1–3 months (n = 5), 34% at 3–6 months (n = 11), 44% at 6 months–1 year (n = 14), and 6% at more than 1 year (n = 2). For spine patients, 6% were allowed to return at 0–1 months postoperatively (n = 3), 37% at 1–3 months (n = 19), 35% at 3–6 months (n = 18), and 22% at 6 months–1 year (n = 11). These data are shown in **Figure 2**. The only peripheral nerve patient was a 21-year-old male patient who suffered a peroneal neuropathy with foot drop after knee surgery. He was allowed to return to playing professional soccer as a forward/striker more than 1 year after exploration and neurolysis of the peroneal nerve with resolution of foot drop (found to have an axonotmetic injury). He suffered no further injuries related to the operative site after return to play.

The 32 patients who successfully returned to play after craniotomy is the largest such number in the available literature. Only 8 craniotomy cases were precluded from returning to their primary sport. Another 3 patients who underwent craniotomy were temporarily restricted from contact for 3 months to 1 year but eventually were allowed to return. Ten patients were required to wear special gear, such as a custom helmet, mask, or padding. One 17–year-old male patient returned to football 6 months status post-