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Clinical Study

A review of surgical intervention in the setting of traumatic central cord syndrome

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Abstract

BACKGROUND CONTEXT: Surgical treatment in the setting of central cord syndrome (CCS) has become safer since Schneider's original description. It is generally accepted that a decompressive surgical intervention is a valid treatment option in a patient with CCS and radiographic evidence of spinal cord compression. The optimal timing of surgical intervention for CCS remains controversial.

PURPOSE: To review a single institution's experience managing CCS, with particular emphasis on surgical versus medical management, timing of surgery, neurologic outcomes, hospital length of stay, and complications.

STUDY DESIGN: Retrospective review.

PATIENT SAMPLE: One hundred twenty-six patients diagnosed with CCS were treated at Wake Forest University Baptist Medical Center between June 1985 and September 2006.

OUTCOME MEASURES: Neurological outcomes were measured using the Frankel grading scale. Other outcome measures included hospital and intensive care unit (ICU) length of stay and complication profiles.

METHODS: A retrospective chart review was performed on patients admitted to Wake Forest University Baptist Medical Center with the diagnosis of traumatic central cord injury from June 1985 to September 2006 with institutional review board approval. Neurologic status was recorded on presentation and at maximum follow-up using the Frankel classification. The surgical cohort was stratified into three subgroups with regard to the timing of surgical intervention after injury: surgery less than 24 hours after injury, surgery greater than 24 hours after injury but during the initial admission, and delayed operative intervention on a second hospital admission. Other variables collected included ICU and hospital length of stay and complication profiles. Data analyses were performed using SPSS (SPSS, Chicago, IL, USA) and Excel 2002 (Microsoft, Seattle, WA, USA).

RESULTS: A total of 126 patients treated for CCS were reviewed. Sixty-seven patients received surgery compared with 59 patients managed nonoperatively. Of those managed operatively, 16 patients received surgery within 24 hours of the time of injury. There were 34 patients who received surgery greater than 24 hours after the time of injury but during their initial admission with a mean time to surgery of 6.4 days (5–52 days). There were 17 patients who received their operation on a second hospital admission with a mean time interval of 137 days between injury and surgery (3–209). Mean follow-up was 32 months (1–210 months). An improvement in Frankel grade was seen in the overall operative cohort compared with those patients who received medical management alone. No statistically significant difference in neurologic outcome using Frankel grades was identified between the surgical subgroups with regard to timing of surgery. A trend toward decreased length of stay was seen in the surgical subgroup that received surgery during their initial

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admission. No statistically significant difference was identified between complication rates for the operative and nonoperative groups; however, a trend toward fewer complications and deaths was seen in those who received surgery in the first 24 hours or during the initial hospitalization.

CONCLUSIONS: Surgical treatment in the setting of CCS has become safer since Schneider's original description. Acknowledging its numerous limitations, this retrospective study supports surgical intervention in the setting of CCS as a safe effective management option. Improved Frankel grades were identified in those patients managed surgically compared with those receiving medical management alone. The data further shed light on the safety and potential benefits of early operative intervention for acute CCS compared with delayed surgical treatment. A prospective randomized controlled trial is needed to definitively compare surgical versus medical management and/or early versus delayed surgical treatment in the setting of traumatic CCS.

Keywords: Central cord syndrome; Incomplete spinal cord injury; Cervical spine

Introduction

The incidence of acute spinal cord injury in the United States is approximately 11,000 new cases per year [1]. Central cord syndrome (CCS) is the most common form of incomplete spinal cord injury [1]. In 1954, Richard Schneider [2] originally described this clinical entity as ''a syndrome of acute central cervical spinal cord injury characterized by disproportionately more impairment of the upper than in the lower extremities, bladder dysfunction, usually urinary retention, and varying degrees of sensory loss below the level of the lesion.'' Although some degree of controversy still surrounds the exact pathophysiology of CCS, recent histopathological evidence correlated to magnetic resonance imaging suggests the lateral cortical spinal tracts as the site of greatest injury in those who demonstrate this clinical entity [3–5].

The most common etiologies of CCS are motor vehicle collisions, falls, and diving injuries [6]. Central cord syndrome is typically seen in one of three populations. A classic scenario is that of a patient older than 50 years with a stenotic, spondylotic cervical spinal canal incurring a hyperextension injury without evidence of fracture. Central cord syndrome is also seen in younger patients who experience high-velocity traumatic injuries, often with associated fracture dislocations. The most recently described subset of patients presenting with acute CCS are patients who have an acute central cervical disc herniation [6–10].

Schneider's early experience treating CCS has had lasting influence on the management of this condition. He operated on the first two patients he managed with CCS. The surgery consisted of laminectomies, sectioning of the dentate ligaments, with transdural exploration anterior to the cervical cord. His first patient awoke quadriplegic and the next awoke no better or worse than before surgery. By and large, the remainder of his patients were managed nonoperatively, and the majority made some significant neurologic recovery. Based on these findings, Schneider et al. [2,11] concluded that surgery was ''contraindicated'' in the management of CCS.

Numerous studies have agreed with Schneider's observation that some recovery after CCS can be expected, and it occurs in a predictable fashion: recovery of lower extremity function followed by upper extremity function [2,11]. However, numerous studies have contradicted Schneider by demonstrating surgical management options to be safe and efficacious in the treatment of acute CCS [7,12–26]. Surgical intervention is advocated in cases of persistent or worsening neurologic deficits and evidence of spinal cord compression on imaging [14]. The timing of surgery remains controversial.

Materials and methods

A retrospective chart review from June 1985 to September 2006 for all patients managed for acute CCS at Wake Forest University Baptist Medical Center was performed with institutional review board approval. Data collected on all patients included general demographic information, overall hospital length of stay, intensive care unit (ICU) length of stay, mechanism of injury, type and level of cervical injury, associated injuries, treating physician, medical comorbidities, and complications. A complication was considered any adverse event during the hospitalization that required a specific intervention. Neurologic outcomes were compared using Frankel grades (Table 1) [27]. A Frankel grade was retrospectively assigned to each patient at presentation and at the most recent follow-up appointment.

Data collected on the operative group included surgeon, type of intubation, presence or absence of steroids given preoperatively, hypotension during surgery, length of surgery, estimated blood loss, and surgical procedure performed. The operative cohort was stratified by patients receiving surgery within 24 hours of their injury, patients receiving surgery after 24 hours of injury but during their initial admission, and those receiving surgery on readmission. For those patients who received surgery on a second hospital admission, length of stay data included the sum of inpatient days from the initial and subsequent admission.

Statistical analysis was performed using SPSS v9.0 (SPSS, Chicago, IL, USA) and Microsoft Excel 2002 (Microsoft, Seattle, WA, USA). For categorical variables, p values were generated using the Fisher exact test for