C-2 neurectomy

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Preservation of neural function is a major goal when surgically treating lesions of the nervous system, its vasculature, and its supporting structures. The development of the complex approaches to access the skull base and anterior thoracic spinal column are examples of deliberate manipulation or resection of neurologically inert tissue to minimize the risk of injury to the nervous system. Occasionally, neural tissue may be sacrificed to increase the likelihood of preserving more critical CNS structures such as the removal of a small portion of the gyrus rectus in selected cases of anterior communicating aneurysms, and the division of a thoracic root to improve access to the anterior spinal canal and vertebral column when operating via a posterolateral approach. It is extremely rare to intentionally create a neurological deficit to improve the exposure of the structures surrounding and supporting the CNS. The original description of dorsal screw fixation of the atlas and axis included the removal of the C-2 root, which was necessary because the bone anchors were connected to each other with a plate.2,3 Hamilton et al.4 present this option as a means to facilitate placement of polyaxial screws into the lateral masses of C-1.

The impact of C-2 neurectomy as it relates to C-1 lateral mass fixation in terms of surgical exposure, blood loss, and other operative parameters cannot be determined by the work of Hamilton et al.4 because of the lack of a concomitant control group. It must be noted that experienced surgeons perform this procedure with excellent results without sacrificing the C-2 nerve roots.3 The key to avoiding bleeding from the venous plexus surrounding the roots is to strictly limit the dissection to the subperiosteal plane. Although this will take a few extra minutes, the surgeon is rewarded with a clear and bloodless view of the dorsal surface to the lateral masses of the atlas. Removal of the C-2 root does not improve exposure to such an extent that it guarantees a vertebral artery injury will not occur.2

Sectioning of the C-2 root is not necessary to treat radicular pain due to C1–2 arthrosis except in rare situations, and it is not required to create a place for graft placement.1,5 The technique is necessary to access the joint in cases of fixed unilateral C1–2 rotary subluxation on the side of which the C-1 lateral mass is anteriorly displaced.

This publication and the experience of Goel et al.2 provide compelling data that C-2 neurectomy is well tolerated, but that has not been a universal experience. Yeom et al. prospectively studied 23 patients in which the C-2 root was transected and reported that 6 patients (26%) had occipital neuralgia at the 1-year follow-up. Two of these patients had unilateral occipital neuralgia preoperatively and suffered from bilateral pain after surgery. The other patients had new pain (JS Yeom et al., presentation at the Annual Meeting of the American Academy of Orthopaedic Surgeons, March 2010). In the commentary following the article by Goel et al.,2 McCormick and Kaiser also reported experiencing this complication after C-2 neurectomy.

The authors are to be congratulated for carefully documenting and reporting patient outcomes following C-2 neurectomy. The data are useful for those surgeons who routinely utilize this technique during atlantoaxial arthrodesis as well as those who perform a neurectomy only in select situations.

Disclosure

Dr. Traynelis serves as a consultant for Medtronic and United HealthCare. He receives research support from Medtronic and NIH and fellowship support from NREF and Globus, and holds several patents.

References
Response

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We would like to thank Dr. Traynelis for his thoughtful review of our article. Dr. Traynelis’ commentary highlights the concerns and anxieties that often arise when a procedure involves sacrifice of normal tissue. We also had many of these concerns initially. However, we had a number of patients with persistent or worsened greater occipital neuralgia when we did not perform a greater occipital neurectomy, and it was the experiences of these patients that primarily prompted us to adopt our current approach. We agree with Dr. Traynelis that a limitation of the present study is the lack of a control group. This limitation does prevent us from making conclusive statements regarding improvements in surgical exposure, blood loss, and operative time afforded by C-2 neurectomy, although we readily appreciate these benefits in the operating room when performing these cases. Notably, during the time the present paper has navigated through revisions and reviewer comments, a similar smaller series has been published that does include a control group. Squires and Molinari10 reported 23 cases of C-1 lateral mass screw placement, with 18 of the procedures including C-2 neurectomy and the remaining cases with preservation of C-2. These authors reported that C-2 neurectomy resulted in less operative time (109 vs 187 minutes, respectively; p = 0.003) and less blood loss (344 vs 1030 ml, respectively; p = 0.01), compared with cases that did not include C-2 neurectomy. The findings of Squires and Molinari add quantitative evidence for the operative benefits associated with C-2 neurectomy.

However, the potential benefits of C-2 neurectomy extend beyond the operating room. As reported in the present article, a substantial number of patients with preoperative occipital neuralgia experienced improvement, if not resolution, of these symptoms postoperatively, and none of the patients experienced new or worsened occipital neuralgia. Dr. Traynelis notes that, although Goel et al.3 provided compelling data that C-2 neurectomy is well tolerated, this has not been a universal experience, citing 2 references. The first reference is an unpublished abstract in which 6 of 23 patients treated with routine C-2 root transection as part of C-1 lateral mass screw placement developed new or aggravated occipital neuralgia. The second reference is to a single sentence in a brief commentary by McCormick and Kaiser following the article by Goel et al.3 that suggests that sectioning of the C-2 nerve root can result in significant symptoms.2 Unfortunately, neither of these references are peer-reviewed publications and further details are very limited. More importantly, both of these references indicate that the C-2 nerve root was “sectioned,” and this approach must be distinguished from a C-2 neurectomy. As described in the present article, our approach was not simply sectioning of the C-2 nerve root, rather we performed a C-2 neurectomy, including ganglionectomy. It is not surprising that injury to the nerve with simple transection, without ganglionectomy, could result in neuropathic symptoms.

As Dr. Traynelis notes, there certainly are many cases in which patients tolerate C-1 lateral mass screw placement without C-2 neurectomy. However, we feel compelled to again emphasize the growing number of reports of C-1 lateral mass screw–induced occipital neuralgia in the literature, and suggest that these reports represent a complication that can seriously affect patient outcome and quality of life.3–10 Although the true incidence of this complication is unknown, that reports documenting its occurrence continue to appear in the literature suggests that the problem may be more widespread than is currently appreciated. It is interesting that spine surgeons would tolerate direct abutment, if not compression, of a nerve root by instrumentation at the level of C-1, yet at any other level of the spine, such an occurrence would likely raise significant concern and could warrant revision surgery.

Again, we appreciate Dr. Traynelis’ thoughtful commentary. We hope that the present study provides reassurance to those surgeons who currently employ C-2 neurectomy when placing C-1 lateral mass screws and hope that our findings help to allay the concerns of those surgeons who do not currently use this approach.

References


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