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radiological data from the presented case report, the fractures the patient suffered are mild compression fractures with limited posterior wall involvement instead of severe burst fractures in which the anterior column integrity is compromised (in the latter case, anterior column augmentation might indeed decrease the need for secondary surgery). The preferred treatment for this type of fracture (that is, A1.3 or very mild A3.1 according to the AO classification) is conservative, just like osteoporotic compression fractures. In the presented case, the pain reduction mechanism proposed by the authors is stabilization of micromotion of bone, which is identical to that in osteoporotic compression fractures after vertebroplasty; it is therefore not entirely surprising that the patient responded so well to the interventional therapy.

In acute burst fractures the bone fragments are highly mobile and remain so until a considerable amount of callus has been formed, incidentally after approximately 3 months. Performing vertebroplasty with polymethylmethacrylate (PMMA) cement in acute burst fractures might not be indicated for at least two reasons.

First, PMMA cement is not able to “glue” bone fragments together after setting of the cement. It will therefore not provide the fragmented vertebral body (VB) with cohesive forces strong enough to withstand the axial and rotation forces a patient is subjected to during mobilization, and bone fragments may become displaced radially by these forces. Furthermore, PMMA cement may actually delay or even prevent osseous fusion when it is injected between bone fragments because it is an inert material. It is thus likely that treatment of burst fractures by vertebroplasty with PMMA alone, will not resolve the problems that are known from conservative therapy: collapse of the VB and subsequent kyphotic deformity.

The second problem is the application of PMMA cement in young and active patients in whom the majority of traumatic spinal fractures occur. Percutaneous vertebroplasty is successful in the treatment of painful osteoporotic compression fractures. The patients presenting with these fractures are, with a few exceptions, aged in their 70s, 80s, or even 90s and are very likely to have degenerated endplates and intervertebral discs. It is until now, however, unclear how PMMA will behave under countless cyclic loadings for decades in the VBs of young patients. We would suggest that some reluctance to use this inert material in younger patients is justified.

Vertebroplasty is a promising technique for various painful conditions of the spine that do not respond to conservative therapy including the case described by Chen, et al. For the treatment of acute burst fractures, however, we would strongly advocate against using (bulloon) vertebroplasty as an isolated procedure, until the aforementioned issues are resolved.

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RESPONSE: We appreciate the comments of Dr. Verlaan and colleagues about our recent publication on percutaneous vertebroplasty (PVP) for the treatment of burst fractures. We agree that the pathophysiology of osteoporotic compression fractures is quite different from traumatic bursting spinal fractures because of considerable differences in the pathophysiology, treatment, and prognosis.

In patients with an acute burst fracture of the thoracic or lumbar spine without neurological deficit conservative treatment is the first choice. In these patients, if the conservative treatment failed then surgical treatment should be considered. The case we reported and a subsequent study also demonstrated that the PVP is an effective way to treat this condition. We suggested that the fracture treated with PVP should be limited to the anterior and middle column and with intact posterior longitudinal liga- ment. Whether a burst fracture with retropulsion of bone into the spinal canal can be reduced and treated with PVP needs further study.

There are several different factors for our patients compared with conventional PVP techniques. With regard to technique, the needles should be inserted within the anterior gap of the burst fracture, not only into the vertebra. The PMMA should clearly fill the gaps between the bone fragments and thus hold the fragments tightly, and not just be inserted only into the osteoporotic trabeculae of the damaged vertebra. Under fluoroscopic examination, the PMMA is distributed as a focal mass within the anterior part of the damaged vertebra, and not diffusely distributed within the whole fractured vertebra. Most important for this kind of treatment is not to fill up the entire fracture site with PMMA but have to leave some fracture space for further osseous fusion. The case we reported and the subsequent study also proved that there was bone fusion of these fractures. Finally, we should emphasize that this procedure carries the potential risk of extravasation of PMMA, and should be performed with extreme caution by experienced surgeons. A syringe compressor for controlled the delivery of the bone cement is also important to avoid the leakage of bone cement. Whether the PVP can be effectively treat the acute burst fracture needs further study.

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References

Intraoperative Monitoring

Abstract

Object. The purpose of this study was to examine the neurological outcomes after complex lumbosacral surgery in patients undergoing multimodality neurophysiological monitoring.

Methods. Sixty-one patients were consecutively enrolled in this study. These patients underwent complex intra- and extradural lumbosacral procedures with concomitant intraoperative electromyography (EMG) monitoring of the lower-limb muscles, external anal and urethral sphincters (EAS and EUS), and lower-limb somatosensory evoked potentials (SSEPs). Long-term (minimum 2-year) clinical follow-up data were obtained in all cases.

Most patients were treated for spinal/spinal cord tumors (61%) or adult tethered cord syndrome (25%). Recordable lower-extremity SSEPs were reported in 54 patients (89%). New postoperative neurological deficits occurred in only three patients (4.9%), and remained persistent in only one patient (1.6%) at long-term follow-up examination. In only one of these cases was a significant decrease in SSEP amplitude detected. Spontaneous EMG activity was observed in the lower-extremity muscles and/or EAS and EUS in 51 cases (84%). Intraoperatively, EMG demonstrated activity only in the EUS in 5% of patients and only in the EAS in 28%. In seven patients (11%) spontaneous intraoperative EMG activity was observed in both the EAS and the EUS; however, in only three of these cases was EMG activity recorded in both sphincters simultaneously. In addition to spontaneously recorded EMG activity, electrically evoked EMG activity was also used as an intraoperative adjunct. A bipolar stimulating electrode was used to identify functional neural tissue before undertaking microsurgical dissection in 58 individuals (95%). In the majority of these patients, evoked EMG activity occurred either in one (33%) or in two muscles (9%) simultaneously. The presence of electrically evoked EMG activity in structures encountered during microdissection altered the plan of treatment in 24 cases (42%).

Conclusions. The authors conclude that the combined SSEP and EMG monitoring of lower-limb muscles, EAS, and EUS is a practical and reliable method for obtaining optimal electrophysiological feedback during complex neurosurgical procedures involving the conus medullaris and cauda equina. Analysis of the results indicates that these intraoperative adjunctive modalities positively influence decision making with regard to microsurgery and reduce the risk of perioperative neurological complications. Validation of the clinical value of these approaches, however, will require further assessment in a larger prospective cohort of patients.

This represents an excellent, long-term follow-up study, which emphasizes the role of electrophysiological monitoring in increasing the safety of complex spinal procedures and preventing unfavorable outcomes. It is remarkable that in their three cases with new postoperative sensory or motor deficits, some degree of intraoperative abnormal electrophysiological finding was observed, further individualizing the value of intraoperative monitoring. Their findings and observations are in agreement with our experience in using multimodality electrophysiological monitoring routinely in all of our spinal procedures. In our experience, there were several cases in which we had to abort or modify a surgical maneuver because of an abnormal EMG or SSEP finding; this was consistent with the authors’ findings. One of the interesting points of the article is the monitoring of both the EUS and EAS.

The authors indicated in their article the importance of combining EMG (lower-limb muscles and external urethral and anal sphincter muscles) and SSEP monitoring. As they have indicated, surprisingly, the presence of postoperative motor deficits can be associated with abnormal SSEP findings without any distinctive EMG changes. In our series, consisting of more than 40 electrophysiologically monitored cases, we have observed two cases of new postoperative cauda equina syndrome, without radiological explanation, after uneventful single-level lumbar microdiscectomy; in both of these cases, significant SSEP changes were intraoperatively documented without any associated noteworthy EMG changes. Unfortunately, we cannot provide an explanation for that finding, but we absolutely agree with the authors that combined (SSEP and EMG) monitoring is beneficial in these cases.

The authors obtained a baseline study after positioning the patient. In cases of trauma or those in which the patient is unstable we routinely obtain a baseline EMG or SSEP study before positioning the patient and immediately after; this strategy can identify, early on, any dangerous positioning maneuvers. We noticed that the authors did not include any trauma cases in their current series but we would like to have their thoughts on that.

Unfortunately, the lack of a control group makes it more difficult to draw conclusions regarding the impact of electrophysiological monitoring in reducing postoperative neurological deficits and pain. In one of our previous studies, intraoperative monitoring did not significantly prevent postoperative pain in patients undergoing routine lumbar procedures.

Furthermore, the authors did not make any comments regarding the effect of systemic blood pressure alterations or level of anesthesia on intraoperative monitoring. They mention in their Results section that some abnormal EMG activity was recorded at the time of closure. It is not clear if this was attributed to some kind of artifact caused by needle insertion during the closure or some persistent EMG abnormal activity at the conclusion of the case. It is not clear if the three cases, with postoperative new deficits, were included in the group of eight patients with persistent EMG activity at the time of surgical closure. The authors also mention in their discussion, that the performing surgeon altered intraoperatively his surgical plan based on the electrophysiological monitoring findings. We wonder if they encountered any cases in which these findings were false positive, and if so, what percentage?

Finally, the authors concluded that their data did not provide any evidence for supporting the intraoperative electrophysiological monitoring of routine low-risk lumbar spinal procedures. Our extensive experience does not support their statement and definitely the data that they have provided in their current study do not support such a statement either.

We would like to congratulate the authors for their well-designed and well-presented study.

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Reference

RESPONSE: We would like to thank our colleagues from The Medical Center of Central Georgia for their comments on our recent study. Our study summarized our experience...