



Neurosurgical Forum

LETTERS TO THE EDITOR

Stent screw–assisted internal fixation and combined radiofrequency ablation and vertebroplasty for stabilization and local tumor control

TO THE EDITOR: We read with great interest the article by Cianfoni et al.¹ (Cianfoni A, Distefano D, Scarone P, et al. Stent screw–assisted internal fixation (SAIF): clinical report of a novel approach to stabilizing and internally fixating vertebrae destroyed by malignancy. *J Neurosurg Spine*. 2020;32(4):507–518). Stent screw–assisted internal fixation (SAIF) is a new percutaneous minimally invasive technique that provides vertebral body reconstruction with a 360° internal fixation for vertebral bodies in cases of osteoporotic and pathological fractures^{1,2} and allows for restoration of the load-bearing capacity of severe osteolytic vertebra.³ We wish to make the following comments:

In the present cohort of patients treated with SAIF, the majority of the vertebrae treated (29/36 levels, 80.5%) underwent periprocedural tumor mechanical cavity creation by curettage and vacuum suction (Q-VAC), intended to reduce the risk of tumor displacement from the vertebral body during cement injection or balloon inflation and to reduce the risk of polymethyl methacrylate (PMMA) cement leak into the spinal canal.⁴ It must be noted that radiologically documented or clinically symptomatic tumor displacement into the spinal canal during vertebroplasty and kyphoplasty is exceedingly rare,⁵ and we have never observed this phenomenon during vertebroplasty and vertebral body stent (VBS) placements in vertebral tumors, even in those with extensive epidural tumor spread. Though theoretically Q-VAC may reduce the risk of tumor displacement, such a complication is likely very rare. Furthermore, in the present study by Cianfoni et al.¹ extra-vertebral cement leaks were observed in 33% of the cases with an epidural or foraminal leak in 19.4%, including two symptomatic epidural leaks both resolving completely, one after laminectomy and the other spontaneously. This relatively high rate of epidural/foraminal leak, which could translate the very advanced locoregional tumor spread of the treated cases in this study, does, however, suggest that Q-VAC was not successful in reducing the risk of extra-vertebral cement leaks.

One potential benefit of Q-VAC that is worth mention-

ing and exploring relates to tumor debulking in terms of achieving a local antitumoral effect. The authors mention in the Q-VAC publication⁴ that it is not intended to achieve local tumor control and that additional standardized oncological therapies such as radiotherapy and/or chemotherapy are warranted to achieve this effect. In that publication, there are no quantitative measures of the volume of aspirated tumor obtained during Q-VAC or mention of epidural tumor debulking being observed on immediate postoperative MRI. The present study was not designed to evaluate the local tumor response to vertebral augmentation preceded by Q-VAC. However, only 2 levels showed signs of local tumor progression on imaging (at 3 and 5 months). It is not specified whether these two patients had undergone periprocedural Q-VAC. There is no information concerning adjunctive systemic chemotherapy or radiation therapy during the study period where 16/36 levels (44%) were followed for ≥ 6 months. Nevertheless, these results could suggest a good local antitumoral effect of SAIF. The contribution of Q-VAC in achieving local tumor control in the present cohort is impossible to determine, but it may be a contributing factor. The exothermic polymerization of the cement, the devascularization of the tumor by the cement injection, and a toxic effect of the cement monomer could certainly be major factors for achieving local antitumoral effect.⁶ Stent placement allows for a high volume of cement injection within the stent, which likely enhances the exothermic reaction of the PMMA as the latter is volume dependent.

Tumor ablation techniques can be combined with vertebroplasty or kyphoplasty in order to achieve additional local antitumoral effect. Radiofrequency ablation (RFA) is increasingly being used to destroy vertebral body tumors prior to injecting PMMA cement. A local antitumoral effect with local tumor control was achieved by Wallace et al.⁷ in 89%, 74%, and 70% of cases at 3 months, 6 months, and 1 year, respectively, of the vertebral levels treated by a combined RFA and vertebroplasty. Furthermore, the authors reported no acute or delayed procedure-related complications, signifying that the procedure is safe. An additional benefit of proceeding with RFA prior to cement injection is the potential reduction of the risk of disseminating tumor cells into the bloodstream during cement injection that could lead to metastatic disease progression.⁸ SAIF and RFA combined with vertebroplasty (CRAV) could, therefore, represent a safe and effective treatment

for metastases with severe osteolysis in terms of local tumor control, vertebral internal stabilization, and pain relief. This is a solution that we currently propose in our institution for such conditions and is under evaluation.

Dr. Cianfoni's group is to be commended for their contribution to the management of osteoporotic fractures and malignant vertebral lesions with their SAIF technique. SAIF has certainly modified our practice by increasing the available armamentarium for treating complex and challenging osteoporotic and malignant vertebral fractures with a minimally invasive and elegant technique. The potential benefit for performing Q-VAC prior to SAIF or SAIF and CRAV in vertebral metastasis with severe osteolysis requires, in our opinion, further assessment.

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Disclosures

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Response

We thank Dr. San Millán for his interest in our article

and his supportive comments on the SAIF technique.¹ We will address his comments in a point-by-point fashion.

Dr. San Millán questions the utility of cavity creation prior to VBS deployment.

We have in fact utilized the Q-VAC technique² to mechanically remove tumor from the vertebral body (VB), through fragmentation, flushing, and aspiration, in 29 of 36 levels, prior to VBS expansion. His logic is that mobilization of soft tissue toward the central canal is an exceedingly rare event. Indeed Laufer et al.,³ utilizing CT myelography, demonstrated that balloon kyphoplasty, in cases of posterior wall destruction, has the potential to cause significant displacement of epidural tumor, reducing the cross-sectional area of the thecal sac. In this series, we reported on “extreme osteolysis” cases, with wide discontinuity of the cortical boundaries of the VB (Tomita score of 4–6)⁴ (Fig. 1 in our article). Furthermore, 28 of 36 levels had posterior wall dehiscence (ESCC [epidural spinal cord compression]⁵ grade > 0), and 14 of 36 had significant central canal encroachment by an epidural tumor component (grade 1c and above). Since SAIF implies expansion of large metallic barrel-shaped stents in the VB, we believe there is potential for dislodgment of a large volume of soft-tissue tumor, and we wished to minimize the risk of worsening central canal encroachment.

Dr. San Millán further speculates that the 19% rate of epidural cement leak indicates inefficacy of the Q-VAC cavity-creation technique. We disagree. Q-VAC is not being utilized as a means to reduce the rate of epidural cement leaks; rather, it is being utilized to remove tissue that might be displaced upon VBS expansion. Furthermore, this rate of PMMA epidural leak is in line with the 20% rate reported by Laufer et al.³ in their case series of metastatic vertebral lesions, especially considering the population being treated in the present series of extreme osteolysis with posterior wall dehiscence.

The last point raised by Dr. San Millán concerns the potential for local tumor control of the SAIF technique. Treatment strategies for these patients were discussed in a multidisciplinary spine tumor board, and while stabilization was achieved with SAIF with or without surgical instrumentation,^{6,7} local tumor control was rather left to standard oncological treatment, including radiation and/or chemotherapy. We believe that the satisfactory rate of local tumor control is due to this multimodal approach. In fact, Q-VAC was performed within the expected boundaries of the affected VB, and the injected cement filled the VBSs and interdigitated around them, while the tumoral vertebral lesions treated in this series were extracompartmental, encompassing the cortical boundaries of the VBs. Therefore, to hypothesize real local tumor control by SAIF, we should assume distant effects of both mechanical cavity and hyperthermic effect of the PMMA, but this has not been demonstrated so far, and we consider it unlikely. The same would in theory apply for RFA, but we are looking forward to the results of ongoing research on RFA and vertebroplasty (CRAV) in the treatment of these challenging vertebral lesions.

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