Letters to the Editor

Vertebral Augmentation of Osteoporotic and Malignant Compression Fractures: Our Viewpoint and Experience in Preventing Cement Leakage

To the Editor:

It is with great interest that we read the article by Georgy et al, "Feasibility, Safety and Cement Leakage in Vertebroplasty of Osteoporotic and Malignant Compression Fractures Using Ultra-Viscous Cement and Hydraulic Delivery System", published in the 2012 May/June issue of Pain Physician (1).

Nowadays, percutaneous vertebroplasty (VP), and kyphoplasty (KP), are valid therapeutic options in the management of severe back pain caused by vertebral compression fractures (2-4). They are minimally invasive, radiologically guided interventional procedures, which involve the injection of polymethylmethacrylate (PMMA) into the fractured vertebral body. Major complications arising from VP or KP are related to leakage of cement beyond the confines of the collapsed vertebral body (1).

This is a thoughtful and well-designed retrospective article which evaluated the safety and feasibility of VP performed for both osteoporotic and malignant vertebral compression fractures using ultraviscous cement injected by a hydraulic delivery system. The results of this evaluation show that highly viscous cement injected by a hydraulic delivery system in VP can be potentially beneficial to decrease the leakage rate when treating osteoporotic and malignant vertebral compression fractures (1). The article also suggests that the hydraulic cement injection device has many advantages and convenience over the most commonly used mechanical injectors. The viewpoint of the author is right, but we have some concern about forcefully injecting cement by the hydraulic injection device used in VP.

It is known that higher viscosity cements used in VP and KP could result in significantly lower cement leakage rates (5-7). However, the increased in situ pressures in the vertebral body generated by the hydraulic injection device during VP may induce unexpected extravasations, especially for malignant vertebral compression fractures which often have high frequency of cortical breakdown by metastatic tissue (5). The degree of cortical disruption determines the viscosity of the cement that can be safely injected. The more extensive the bony disruption, the greater the viscosity of the cement is recommended since this will decrease the risk of unwanted extravasation (8). Our viewpoint is that low pressure fill of higher viscosity cement into the fractured vertebral body may result in significantly lower extravasation rates of PMMA.

The most important advantage of KP over VP is the ability to create a cavity into the vertebral body by using the inflatable balloon for the injection of a very viscous cement with very low pressure into the cavity, significantly reducing the probability of cement leakage (Fig. 1.). The application of cement during KP is done via a bone filler device and not through a syringe or injector system (5,9). Another advantage for KP is the compression of cancellous bone during the intravertebral expansion of the balloon which creates a condensed spongiosa layer surrounding the void which may close possible cortical breakdown of the vertebral body, thus further reducing the risk of subsequent cement leakage, and allows bone repair to occur on the surface of the PMMA cement (5,10). For patients with damage to the vertebral wall, leakage of PMMA through cortical defects is very high. In our experience, the leakage can be avoided with good technique. We first insert 1 mL of viscous cement after expanding the intravertebral space and removing the balloon. Next, we reinsert the balloon into the cement and reinflate it, in order to expand the surrounding cement until it abuts the compromised vertebral wall. At this stage, we

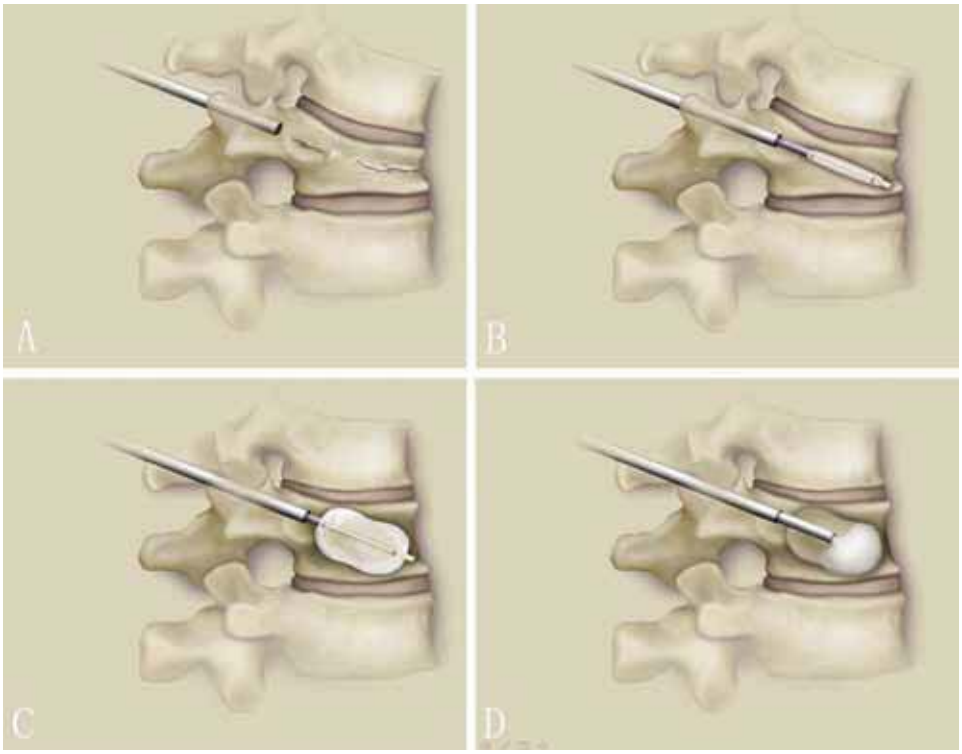

Fig. 1. *Kyphoplasty technique. (A) Vertebral compression fractures cause vertebral body collapse; (B) An inflatable balloon is advanced through a cannula placed in transpedicular fashion; (C) The balloon device is inflated in an attempt to create a cavity into the vertebral body; (D) The cavity created by the balloon is filled with very viscous cement under very low pressure, significantly reducing the probability of cement leakage.*

allow the cement to harden. Then we remove the balloon and proceed with conventional cement filling. As a result of using these techniques, no symptomatic cement leakage occurred among our patients (5).

In summary, KP is considered a "low-pressure" injection and VP is considered a "high-pressure" injection technique. To patients with osteoporotic and malignant compression fractures, we also advise using highly viscous cement in the vertebral augmentation process, however, the creation of a bony void and subsequent low pressure in the vertebral body are recommended to reduce extravasation rates of PMMA.

Zhao Huan, MD
Shi Qin, MD, PhD
Sun Zhi-Yong, MD
Department of Orthopaedic Surgery
First Affiliated Hospital of Soochow University
Suzhou, Jiangsu, China

Zhang Ning, MD, PhD
Yin Guo-Yong, MD, PhD
First Affiliated Hospital of
Nanjing Medical University
Nanjing, Jiangsu, China

Yang Hui-Lin, MD, PhD
Chairman and Professor
Department of Orthopaedic Surgery
First Affiliated Hospital of Soochow University
188 Shizi St.
Suzhou, Jiangsu 215006, China.
E-mail: soochowspine@139.com

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Response

We appreciate the author's thoughtful and constructive critique for the article. Although the authors agree on the benefit of high viscosity cement, they are concerned about using a hydrolic injection device that can potentially create high pressure inside the vertebral bodies with subsequent increased risk of extravasation. The authors then describe kyphoplasty as an alternative technique that allows low-pressure injection of highly viscous cement. Furthermore they describe what is known as an "egg-shell" technique to further reduce the extravasation rates in cases with severe cortical disruption.

The hydrolic system is designed to generate enough force to allow movement of the high viscous cement through small caliber needles and not to apply high-pressure inside the vertebral body. Pressure is first applied to water that then is transmitted to the cement container before it enters the needle into the vertebral body. Needles are designed with a relatively larger inner diameter than the standard sizes to allow for the highly viscous cement to flow under lower pressure.

Although kyphoplasty allows injection of cement under low pressure, we should not ignore the fact that high pressure had been already applied inside the vertebral body when the balloon was first inflated before cement injection. Considering the very high pressure that sometimes is required to elevate a depressed end plate, kyphoplasty is not a low-pressure technique. The compressed cancellous bone created by balloon inflation theoretically can decrease leakage but also can decrease cement interdigitation especially if combined with high viscosity cement.

We are also concerned about using a balloon and creating high pressure inside tumors with the theoretical risk of displacement of tumor cells outside the compromised boundaries of the vertebral body. There is no theoretical benefit of height restoration, cavity creation and compression of "cancellous" bone in malignant metastatic lesions.

The elegant "egg-shell" technique described by the authors is definitely useful to decrease leakage however, this is technically demanding and some operators may not be comfortable performing it, especially those with little experience. It could be difficult to perform with severely compressed vertebrae in high thoracic lesions. I am not sure if this technique can be the standard for treating compression fractures.

Regardless of the technique used, vertebroplasty or kyphoplasty,I believe we need to emphasize for the readers that using good basic rules and habits are essential to prevent leakage during vertebral augmentation procedures. Good fluoroscopy and injections of cement under real time fluoroscopy are essential. Once the operator feels increased pressure or recognizes a start of the extravagation,, injection should be stopped and the needle tip repositioned.

Bassem A Georgy, MD
North County Radiology
Escondido, CA 92025
Assistant Professor of Radiology
University of San Diego
255 N Elm Street, Suite 204
Escondido, CA 92025
E-mail: bassemgeorgy@ymail.com