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A Focused Review

Vertebroplasty and Kyphoplasty

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Vertebroplasty and kyphoplasty are relatively new techniques used to treat painful vertebral compression fractures (VCFs). Vertebroplasty is the injection of a vertebral body with bone cement, generally polymethylmethacrylate (PMMA). Kyphoplasty is the placement of balloons (called "tamps") into the vertebral body with an inflation/deflation sequence to create a cavity prior to the cement injection. These procedures are most often performed in a percutaneous fashion on an outpatient (or short stay) basis. The mechanism of action is unknown, but is postulated that stabilization of the fracture leads to analgesia. The procedure is indicated for painful vertebral compression fractures due to osteoporosis or malignancy, and painful hemangiomas. The procedure may have efficacy in painful vertebral metastasis and traumatic compression fractures. Much evidence favors the use of this procedure for pain associated with these disorders. The risks of the procedure are low but serious complications occur. The risks include spinal cord compression, nerve root compression, venous embolism, and pulmonary embolism including cardiovascular collapse. The risk/benefit ratio appears favorable in carefully selected patients. The technical aspects of the procedures in presented in detail along with patient selection. A comprehensive review of the evidence for the procedure and its reported complications is presented.

Keywords: Vertebroplasty, kyphoplasty, vertebral compression fracture, hemangiomas, osteoporosis, spinal metastasis, spine fractures, spine interventional procedures

Vertebroplasty and kyphoplasty are relatively new techniques used to treat painful vertebral compression fractures (VCFs). Vertebroplasty is the percutaneous injection of a vertebral body with bone cement, generally polymethylmethacrylate (PMMA). PMMA has been used in orthopedics since the late 1960's (1). Percutaneous vertebroplasty (PV) was first reported by a French group in 1987 for the treatment of painful hemangiomas (2). Over the next 15 years, a variety of groups have advocated expanding the indications for PV to include osteoporotic compression fractures, traumatic compression fractures, and painful vertebral metastasis (3-5).

Kyphoplasty is a modification of PV. It involves the percutaneous placement of balloons (called "tamps") into the vertebral body with an inflation/deflation sequence to create a cavity prior to the cement injection. Percutaneous kyphoplasty (PK) may restore vertebral body height and reduce the kyphotic angulation of the compression fracture prior to PMMA injection (6). The technical aspects of the procedures are presented in detail along with patient selection. A comprehensive review of the evidence for these procedures and their reported complications are presented.

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Vertebral Compression Fractures (VCFs)

Osteoporotic fractures are highly prevalent in elderly women, with an annual estimate of 1.5 million fractures in the USA. These include 700k VCFs, 250k hip fractures, 250k collar fractures, and 300k fractures of other limbs. The annual cost of these fractures was estimated in 1995 at $5 to 10 billion dollars, and more recently estimated at $13.8 billion dollars annually in the USA (7, 8). VCF has been defined as at least a 15% decrease in vertebral body height. The prevalence of VCF in women aged 50 and over has been estimated at 26% (9). The prevalence increases with increasing age, reaching 40% in 80-year-old women (10). Cooper et al (11) noted that 84% of VCFs were associated with pain. The pain of the fracture usually lasts 4 to 6 weeks with intense pain at the fracture site. Chronic pain often occurs when one level is greatly collapsed or multiple levels are collapsed.

A large prospective cohort study revealed that elderly women sustaining VCFs had a higher age adjusted mortality rate than the cohort not sustaining VCF. Kado et al (12) reported a prospective cohort study following 9,575 women age 65 and older for a mean follow-up of 8.3 years. Mortality was proportional to number of compression fractures. Annual mortality rose from 19 per 1000 women-years in those without VCF to 44 per 1000 women-years in those with 5 or more fractures. The increased mortality was primarily due to pulmonary causes or cancer. Schlaich et al (13) showed a significant decrease in pulmonary function test parameters, namely vital capacity (VC) and forced expiratory volume in 1 second (FEV1), in patients with VCFs versus an aged matched group with chronic low back pain.

Thus, the clinical consequences of VCF include loss of height, exaggerated thoracic kyphosis with lumbar lordosis, with associated pulmonary difficulties (14). Loss of mobility and decreased exercise tolerance are common, with associated chronic depression, which may worsen the chronic back pain associated with the deformity.

When treating patients with osteoporosis, several caveats of treatment are important. This is a systemic disease requiring systemic treatment. For most interventional specialists, this is beyond the scope of their practice and patients are managed by their primary care physician or an endocrinologist. Calcium supplements, vitamin D, hormone replacement therapy, selective estrogen replacement modulators, bisphosphonates, intranasal calcitonin, are pharmacologic treatments often used alone or in combination (15). The importance of weight bearing exercise and fall precautions should always be emphasized.

Patient Selection

Ideal candidates for PV or PK have mostly activity related axial pain corresponding to the level of a recent compression fracture. This pain lessens or goes away completely with recumbency and/or sitting still. Many clinicians use tenderness over the appropriate level as an indicator for PV or PK, although recently Gaughen et al (16) analyzed a series of 90 patients undergoing PV and found 10 who had no tenderness preoperatively. Subgroup analysis on that group of 10 patients reveals excellent outcomes, thus these authors argue for a careful evaluation of the history, MRI findings, plus possible bone scan findings, but not making pain on palpation a necessary requirement for PV. A complete neurologic exam and recent radiographic imaging is mandatory. Magnetic resonance imaging (MRI) will show an increased T-2 signal due to bone edema at the level with a recent fracture. Bone scan has also been used to target the most recent fracture (s) in patients with multiple fractures (17). Cord compression on MRI (in the absence of neurologic findings) is a relative contraindication. If on MRI there is a suspicion of a posterior cortical fracture, a computed axial tomography (CAT) will reveal more details of the bony architecture. Plain spine radiographs may help to give an idea of pedicle anatomy to plan the procedure, i.e., small pedicles may favor PV with a smaller needle versus the larger trocar with PK.

General Tenets/Contraindications

Prior to the procedure, the patient should be off of all anticoagulants and their coagulation profile should be normal. Platelet count should be at least 100,000 at the time of the procedure. Sepsis is a contraindication. Active infection is a contraindication. The authors recommend waiting 2 weeks after treatment of an infection to minimize infectious risks.

Informed consent (see Complications section below) should include: lack of pain relief, osteomyelitis, fracture of the vertebra or pedicle, extravasation of cement into the spinal canal or neural foramen, paralysis or nerve root damage, and venous embolism. Also, the need for open surgery should be discussed with the patient.

Procedural Technical Aspects

Vertebroplasty and kyphoplasty require the clinician to be trained in spinal anatomy, fluoroscopic imaging, and the use of these techniques to perform interventional procedures. The procedure should be performed in a sterile OR suite that will allow fluoroscopic imaging of the thoracolumbar spine. Biplanar or C-arm fluoroscopy of good quality is mandatory for maximal procedural safety. A radiolucent table is mandatory, as is appropriate padding for prone slightly flexed positioning. Other procedural materials needed include local anesthetic solution (the authors use a 50:50 mixture of 1% lidocaine with 0.25% bupivacaine), PMMA material, barium or other radioopacification material. Some groups have advocated tobramycin powder. Eleven gauge or 13 gauge bone biopsy needles with connection tubing and cement injection syringes are needed. Many commercial kits are available (see Appendix 1 for materials list and vendors addresses).

General anesthesia or monitored anesthesia care (MAC) can be utilized. If MAC is used the surgeon must use generous amounts of local anesthetic, especially onto the periosteum, where much nociception occurs. Some patients experience discomfort with advancement of the trocars across the posterior cortical margin, with balloon inflation (in the case of kyphoplasty), and with PMMA injection. The anesthesiologist must be prepared to "deepen" the MAC during these phases of the procedure. Patient selection is important with consideration to the anesthesia choice. Very anxious or nervous patients may have a better experience with a general anesthetic. Careful consideration must be given to padding the pressure points of this fragile group of patients.

After uni- or bi-pedicular vertebral body access has been obtained, some clinicians proceed directly with injection of PMMA, whereas others prefer to do venography prior to cement injection. In theory, venography provides anatomic knowledge of large venous channels proximity to the trocar. This information is used to more carefully inject the PMMA. For example, if a small amount of contrast injection reveals a direct spread into a venous channel, the operator may move the trocar prior to injection or carefully inject relatively solidified PMMA to embolize the large vein prior to injecting more PMMA into the vertebral body. The literature reveals variable efficacy of the use of venography (18-20). The authors use venography in cases where a metastatic tumor is located near the posterior cortical margin. In cases of osteoporotic fractures, the authors do not routinely use venography.

PMMA injection into the vertebral body is undertaken after careful imaging confirming location of the trocar or trocars into the anteromedial portion of the vertebral body (Figs. 1-4). The PMMA should be opacified and beginning to harden to the consistency of toothpaste prior to injection. Injection can be done by small syringes filled with PMMA or one of several commercially available kits. The injection *must* be done under live lateral or bi-planar fluoroscopic guidance. If PMMA begins to go into a blood vessel or toward the posterior cortical margin, it must be halted immediately. The authors halt cement injection when it spreads to the posterior one-third of the vertebral body (Fig. 2). In order to minimize PMMA leakage, Fourney et al (21) recommend the use of high viscosity cement, kyphoplasty in selected cases, and relatively small volume injection.

Outcomes

There have been many outcome case series studies both of the retrospective review and prospective type (Table 1). Many of these studies are of a very high quality and are reviewed below. To our knowledge, no randomized controlled trials of PV versus conservative treatment have been done. With such good clinical outcomes in PV and PK, such a trial may be difficult to conduct as patients and clinicians would be unenthusiastic about being randomized to the conservative treatment arm. There also are no controlled

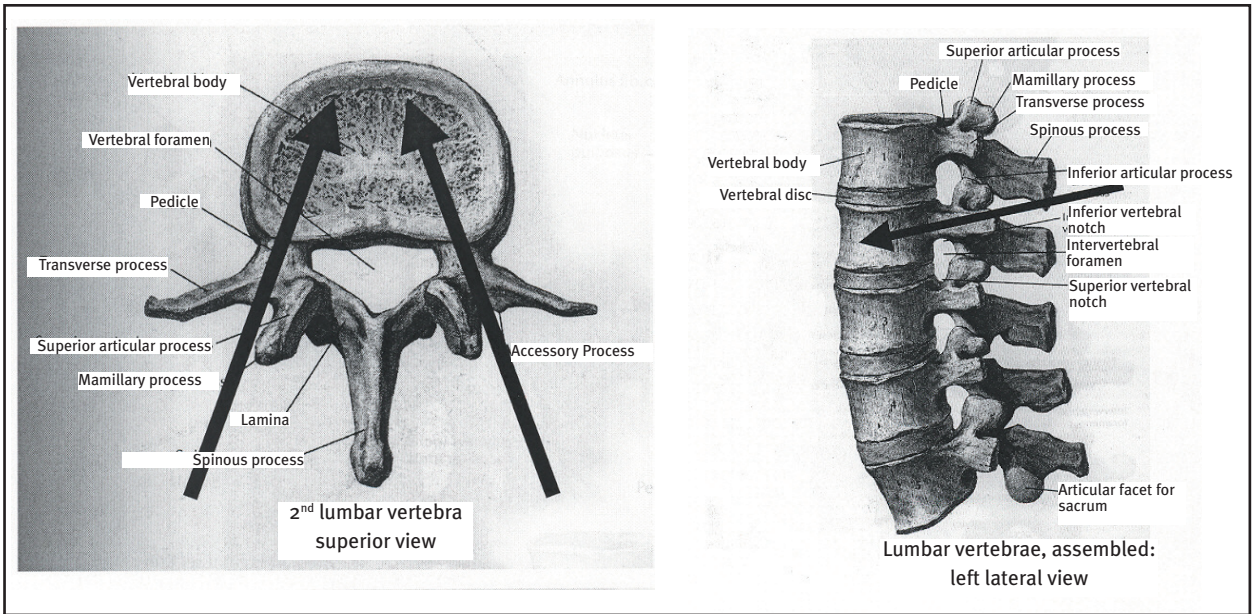

Fig 1. *Axial and lateral schematic for percutaneous vertebroplasty trochar placement in the lumbar spine*

trials comparing PV and PK.

Percutaneous Vertebroplasty (PV) in Osteoporotic VCFs

Zoarski et al (22) performed a prospective analysis of 30 patients undergoing PV at 54 levels for osteoporotic VCFs with follow-up out to 18 months. Their patients had a mean age of 79 and were predominately female. Patients were evaluated with an instrument called the MODEMS (Musculoskeletal Outcomes Data Evaluation and Management Scale). Significant improvement was noted in pain and disability, physical function, and mental function. These improvements were seen by 2 weeks and were durable to 18 months follow-up. One patient suffered an asymptomatic epidural PMMA leak.

McGraw et al (23) prospectively evaluated 100 patients undergoing PV for osteoporotic VCFs. These patients underwent 156 levels of PV, 68 thoracic and 88 lumbar over a 35-month period. Ninety-seven percent of patients reported significant pain relief at 24 hours sustained out to a mean follow-up of 21 months. The pain scores dropped from 8.9 to 2.0 post-procedure. 93% of patients noted an increased activity level. They had 2 complications including a sternal fracture and a transient radiculopathy.

Cortet et al (24) prospectively evaluated 16 patients undergoing PV for osteoporotic VCFs. These patients underwent 20 levels of PV. Pain scores significantly improved (VAS and McGill) by a mean of 56% by day 3 and this was sustained out to day 180. The Nottingham Health Profile improved significantly in the dimensions of pain, physical mobility, emotional reactions, social isolation, and energy. There were no complications, nor any further VCF and the improvements were sustained out to a 6-month follow-up.

Perez-Higueras et al (25) prospectively assessed clinical and radiographic outcomes in 12 patients over a 5-year period. Initial pain scores were 9.1/10, falling to 2.1/10 on the 3rd day post procedure and 2.2/10 at 5 years. The McGill Pain Questionnaire showed a significant improvement after treatment, but worsened by the 5-year follow-up. All patients were "very" or "somewhat satisfied" with the procedure. 3 patients had 4 new fractures over the 5-year follow-up period, 2 of which were adjacent to treated levels. CT revealed cement in the epidural veins on 48% of cases, but only 1 patient had a transient neuritis.

Grados et al (26) provided insight into the long-term outcomes with a long-term retrospective follow-up analysis. PV was carried out in 40 patients between 1990 and 1996 for osteoporotic VCFs. In 1997, the patients were asked to return for re-evaluation. The mean duration of

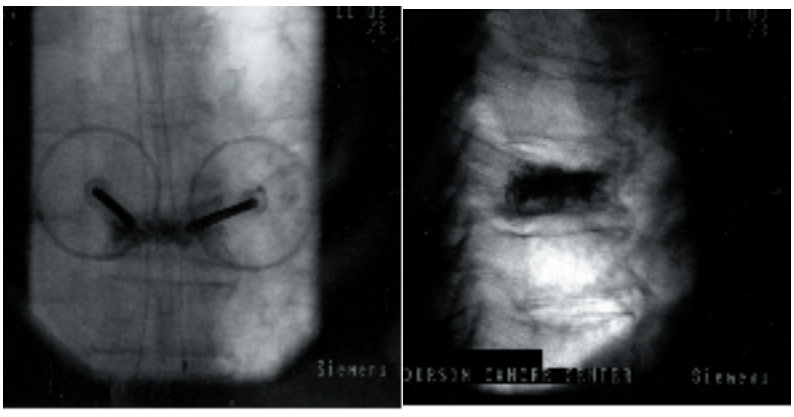

Fig 2. *Anterior-posterior and lateral radiograph of lumbar vertebroplasty, after PMMA injection*

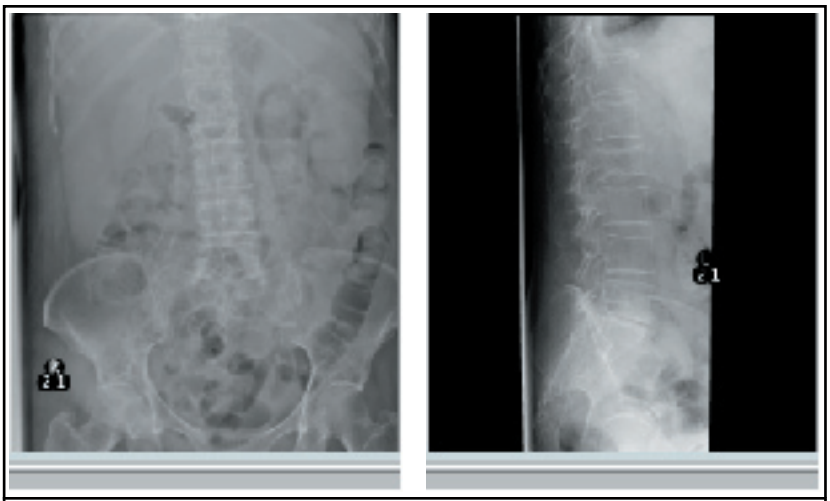

Fig. 3. Anteroposterior and lateral radiograph of L2 osteoporotic compression fracture

follow-up was 48 months post PV. Pain scores decreased from 8.0/10 pre-procedure to 3.7/10 at 1-month follow-up and 3.4/10 at maximal follow-up. There were no complications, but they found a slightly increased risk of VCF in adjacent vertebra to the treated level. The odds ratio of a fracture in the vicinity of a treated level was 2.27 versus 1.44 in a remote location to the treated level. The significance of this is unclear. The authors concluded that PV is a safe and effective procedure to treat focal back pain secondary to osteoporotic VCF.

Barr et al (27) performed a retrospective review of 47 consecutive patients over 3 years treated with PV at 84 vertebral levels. Thirty-eight of the patients had osteoporotic VCFs, 8 patients had primary or metastatic tumor related VCFs, and 1 patient had a hemangioma. Among the 38 patients with osteoporosis, 63% had marked pain relief, 32% had moderate pain relief, and 5% had no significant change. In the group with tumor related VCF only 50% had significant pain relief. The patient with the hemangioma got no pain relief. Three patients had minor complications.

Percutaneous Kyphoplasty (PK) in Osteoporotic VCFs

Lieberman et al (28) in a prospective open label phase I trial of PK for osteoporotic VCFs, reported on thirty patients who underwent 70 levels of PK for painful osteoporotic VCFs. SF-36 scores showed significant change for bodily pain and physical function post procedure. Seventy percent of these patients had restoration of, on average, 47% of their lost vertebral body height. There was an 8.6% rate of asymptomatic PMMA leakage.

Ledlie and Renfro (29) reported a large retrospective review of 96 patients having undergone PK at 133 levels mainly for osteoporotic VCFs. The mean patient age was 76 and 70% were female. The mean pre-procedure pain score was 8.6/10, 2.7/10 in the near post procedure period and 1.4/10 at the 1-year follow-up mark. Most patients' activity levels dramatically improved. In PK, vertebral body height is often restored and in this cohort, the mean anterior vertebral body height changed from 65% of normal pre-procedure to 90% of normal at 1 month postprocedure.

Outcomes in Cancer

Fourney et al (30) reported a retrospective review of 56 patients undergoing 65 PV and/or 32 PK procedures for cancer associated VCFs. Twenty-one patients had myeloma whereas 35 had other primary and metastatic neoplasms. Mean age was 62, with a mean duration of symptoms of 3.2 months. Eighty-four percent of patients reported marked or complete pain relief post procedure with a mean follow-up of 4.5 months. No treatment related complications were seen. Asymptomatic PMMA leakage was noted in 9.2% of 65 levels treated with PV whereas there was no PMMA leakage in the PK group. These authors (30) presented an algorithm for choosing PV, PK, surgery, or radiotherapy in the cancer patient.

Dudeney et al (31) prospectively evaluated a series of patients with multiple myeloma undergoing PK for painful VCFs. Eighteen patients underwent 55 PK procedures due to multiple myeloma. SF-36 scales showed post-procedure improvement for the bodily pain, physical function, vitality, and social functioning scales. On average, 34% of lost vertebral height was restored. No major complications were seen and asymptomatic PMMA leakage was seen in 4% of treated levels.

Wang et al (32), in our institution, reported in abstract form our experience with myeloma patients. Retrospective analysis of 32 patients undergoing 43 PV and 24 PK procedures was undertaken. Ninety-one percent of patients reported marked or complete pain relief post procedure. Mean pre procedure pain score

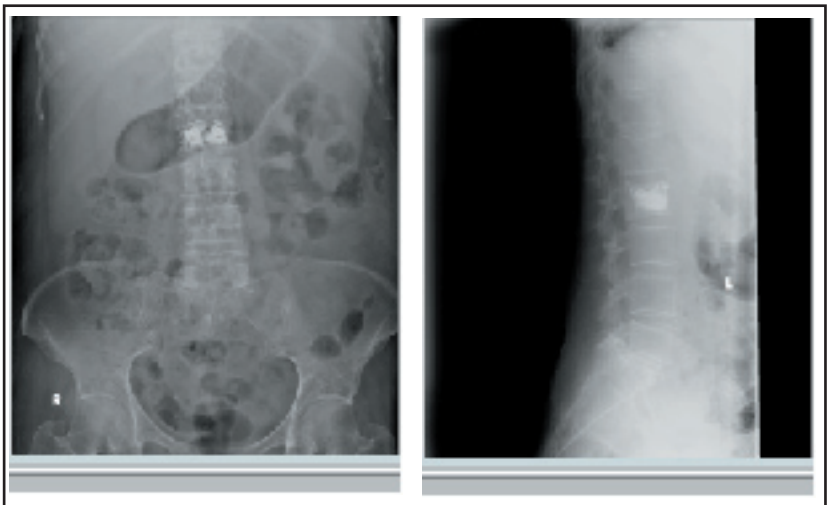

Fig. 4. Anteroposterior and lateral radiograph of L2 compression fracture post vertebroplasty

was 7/10 and the postoperative mean pain score was 2/10 which was durable to a 12 month follow up period. No major complications were seen, but asymptomatic PMMA extravasation was noted in 4% of the patients undergoing PV.

Outcomes in Special Circumstances

As experience grows with these techniques, various groups are pushing the envelope on indications for the procedure. There is some preliminary data/case series on efficacy in patients with radicular pain, traumatic burst fractures, severe VCF/vertebral plana, cervical spine pathology, and intra-operative PMMA augmentation of pedicle screw fixation spinal stabilization (33-37).

Complications

Complications are rare, but can be serious-the exact incidence is unknown. PMMA can flow out of the vertebral body posteriorly into the spinal canal, neural foramina, or anteriorly into the paraspinous veins with systemic consequences. There are case reports of nerve root and spinal cord compression from extravertebral PMMA (38, 39). Several reports of minimally symptomatic pulmonary emboli, one case of cardiovascular collapse requiring pulmonary embolectomy, one lethal pulmonary embolus and one case of paradoxical cerebral arterial PMMA

Table 1. Results of outcomes of vertebroplasty and kyphoplasty

Study/Methods	Patients	Procedural Details	Outcomes	Results	Complications	Conclusion(s)
Zoarski, et al. (19), prospective case series	30 patients with 54 osteoporotic VCFs	PV at 54 levels	MODEMS Scale	Sig. Improvement in pain, disability, physical function, mental function	1 asymptomatic epidural PMMA leak	Durable improvement out to 18 months f/u
McGraw, et al (20), prospective case series	100 patients with 156 osteoporotic VCFs	PV at 156 levels, 68-T, 88-L	NRS Pain Scores, Activity Level	Pain scores 8.9 to 2.0, 93% increased activity level	1 transient radiculopathy, 1 sternal fracture	Durable improvement out to 21 months f/u
Cortet,et al (21), prospective case series	16 patients with 20 osteoporotic VCFs	PV at 20 levels	VAS, McGill Pain scores, NHP	Pain scores sig improvement, NHP w/improvement in QOL measures	None	Durable improvement out to 6 month f/u
Perez-Higueras, et al (22), prospective case series	12 patients with 12 osteoporotic VCFs, 4 new VCFs over next 5 years	PV at 12 levels, initially, PV at 4 new levels	VAS, McGill Pain scores, satisfaction question	Pain scores 9.1 to 2.2 out to 5 year f/u, All pts "somewhat or very satisfied" w/PV	48% PMMA leak into epidural veins, 1 pt had transient neuritis	Durable improvement out to 5 years, with good response in new VCFs also
Grados, et al (23), retrospective six year analysis	40 patients with VCFs treated over 6 years	PV at levels	VAS, new VCFs	Pain scores 8.0 to 3.4 at maximal follow-up (mean of 48 months), sl. Increased risk of new fx in adjacent level		Safe and effective RX for VCF, durable improvement to 48 months
Barr, et al (24), retrospective 3 year analysis	47 patients with 84 VCFs, 38 osteoporotic, 8 tumor related	PV at 84 levels	VAS	63% marked pain relief in osteoporotic group, 50% significant pain relief in tumor group	3% minor complicatiions	Safe and effective for osteoporotic and tumor related VCFs, better relief in osteoporotic VCFs
Lieberman, et al (25), prospective case series	30 patients with 70 osteoporotic VCFs	PK at 70 levels	SF-36	Sig improvement in bodily pain and physical function on SF-36, 70% had restoration of 47% VCF height on average	8.6% asymptomatic PMMA leakage	PK safe, effective for osteoporotic VCFs
Ledlie and Renfro (28), retrospective review	96 patients with 133 osteoporotic VCFs	PK at 133 levels	VAS, Activity level	Pain scores 8.6 to 1.4 at 1 year f/u, 25% VB Height restoration		PK safe, effective for osteoporotic VCFs
Fourney, et al (29), retrospective review	56 patients with 97 cancer related VCFs	PV at 65 levels, PK at 32 levels	Pain relief scale,	84% marked pain relief post procedure, mean f/u of 4.5 months	9.2% asymptomatic PMMA leak in PV group; 0% in PK group	PK, PV safe and effective for treating cancer related VCFs
Dudeney, et al (30), prospective case series	18 patients with myeloma; 55 VCFs	PK at 55 levels	SF-36	Post procedure sig improvement in bodily pain, physical function, vitality, and social functioning	4% asymptomatic PMMA leakage	PK safe, effective for treating myeloma related VCFs
Wang, et al (31), retrospective review	32 patients with myeloma; 67 VCFs	PV at 43 levels; PK at 24 levels	VAS pain socres	Pain scores 7 to 2 at 1 year f/u	4% asymptomatic PMMA leakage	PK, PV safe and effective for myeloma related VCF

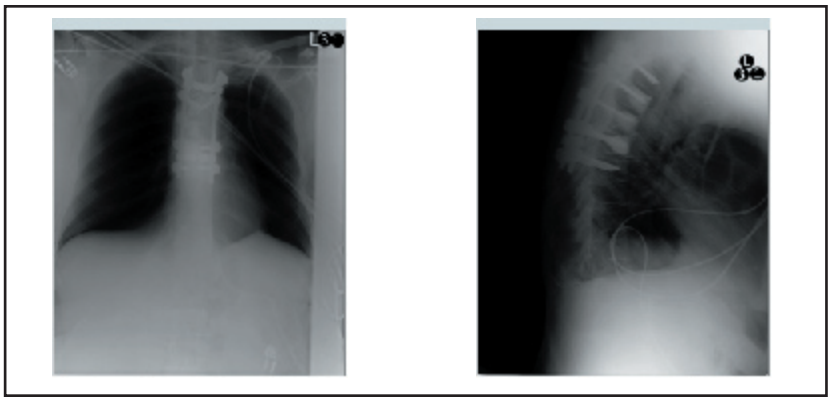

Fig. 5. *Anteroposterior and lateral images of thoracic fusion with vertebroplasty augmented pedicle screw fixation*

emboli have been reported (40-43). There is a suggestion in the literature of less PMMA leak with PK versus PV (44). The clinical significance of this is uncertain. As further studies are completed a more complete risk benefit ratio can be defined.

Conclusion

Percutaneous vertebroplasty (PV) and percutaneous kyphoplasty (PK) are newer minimally invasive techniques used to treat painful vertebral compression fractures (VCFs). There is a growing body of evidence, albeit of limited quality-predominately open case series, which indicates this procedure is efficacious in alleviating the pain associated with VCF. The results of the procedure in these numerous reports are uniformly good. There are, however, a growing number of case reports of serious complications.

Recent reviews and editorials have called for a more critical evaluation of these procedures. Watts et al (45) reviewed the literature concluding that controlled multicenter trials are needed to determine the short and long-term safety. Garfin et al (46) concluded that there is a 95% improvement in pain and significant improvement in function following these procedures. They emphasized that the procedure is technically demanding with the potential for significant complications. They recommended further efficacy and safety studies. Jarvik and Deyo (47) called for randomized controlled trials or some type of control cohort to compare long term outcomes carefully. Einhorn (48) calls for careful monitoring of outcomes and minimal training standards. Birkmeyer (49) calls for randomized clinical trials, citing insufficient evidence via case series to prove safety, efficacy, and cost-effectiveness.

It will be difficult to conduct the randomized controlled trials (RCTs) needed to compare short and long-term outcomes of PV and/or PK versus more conservative therapies. These procedures have gained such widespread popularity; patients would undoubtedly resist being randomized to the conservative treatment group. Blinding would be impossible, as pain relief is usually dramatic and prompt. Other studies need to be done to compare PV and PK in various disease states in a randomized fashion. Early studies are underway to evaluate biologic materials for spinal injection rather than acrylic (PMMA). In spite of the need for more research, PV and PK have shown great promise in the treatment of painful VCFs due to a variety of different pathologic states.

Disclosure

The authors have no financial relationship with any of the companies listed below and make no specific recommendations regarding materials and equipment.

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SIMPLICITY OF RANDOMIZED, CONTROLLED TRIALS OF PERCUTANEOUS VERTEBROPLASTY

The readers of Pain Physician have been very fortunate to have the opportunity to read a very thorough review article on percutaneous procedures for the treatment of painful compression fractures. By and large, the authors have effectively discussed advantages and disadvantages of both percutaneous vertebroplasty and percutaneous kyphoplasty. The purpose of this invited commentary is to discuss one aspect of the paper; the ability to perform a randomized, controlled study of percutaneous vertebroplasty. There is little doubt that percutaneous kyphoplasty could be approached in the same fashion and equally little doubt that it will in the relatively near future.

Vertebroplasty is a well-established procedure that has been "seemed" efficacious in clinical practice extending over 10 years. Published case series examining thousands of patient cases attest to its "anecdotal" safety and efficacy.

However, the procedure is done as an off-label use of products approved by the FDA for other procedures. The call for randomized, clinical trials to prove the efficacy and safety of specific products for use in vertebroplasty has been the topic of much debate over the past few years. For example, Jarvik and Deyo wrote a letter to the editor in the American Journal of Neuroradiology calling for such a trial to clear the final, formal, scientific hurdle for a procedure that had become a standard of care for pain caused by vertebral compression fractures (1).

In their current article, Burton and Mendel reference several of the key papers calling for carefully monitored clinical trials; however, they assert that difficulty in enrolling patients and maintaining blindness to the control group will make randomized controlled trials for short and long-term outcomes of vertebroplasty problematic (2).

The authors of this commentary respectfully disagree with several aspects of this assertion, and offer the following references in the spirit of advancing the procedure for the benefit of the patient population now and in the future.

Over the past several years, there has been an increasing prevalence of placebo controlled studies for surgical procedures and non-surgical interventions. The success of these studies proves the efficacy of the study method itself in this arena; the inclusion of a control group is the basic premise of "good science".

More specifically, in 2002, Kallmes et al, demonstrated the feasibility of patient enrollment into a sham-controlled trial of verterboplasty(3). In that study, patients agreed to be enrolled knowing they might be randomized to the sham. The outcome of that study provided surprising insights, including the importance of the placebo effect as a valid study point in pain management and pain interventions.

Do et al have further demonstrated the feasibility with their prospective randomized study comparing vertebroplasty to medical therapy for acute vertebral compression fractures in 31 patients(4). Their findings indicate that all patients randomized to vertebroplasty had significant improvement in measured outcomes following vertebroplasty. Patients who were randomized to medical therapy had no improvement in pain, mobility, and narcotics intake. Additionally, all patients who were offered vertebroplasty after failure of medical therapy experienced significant improvement after their procedure. This is a strong finding for vertebroplasty as a pain intervention; it is more important as an indicator of the ability to enroll patients in a randomized, controlled trial involving non-intervention as a method of treatment.

Simultaneous with the presentation of papers by Kallmes et al and Do et al, was the announcement by Parallax Medical, Inc., of the first FDA approval of a randomized clinical trial of vertebroplasty products. (5) The trial design was approved by the FDA to include multiple centers, with a single-masked, randomized method including a placebo – a sham procedure. Patients who enroll in the trial and believe they have been randomized to the control group have the option of crossing over for vertebroplasty after a certain period, defined so patients would not be denied treatment for an extensive period. The Parallax trial has been underway for several months, involving many of the most prominent vertebroplasty practitioners at leading centers in the U.S. Patients have been enrolled and the study is proceeding according to the FDA-approved plan. Preliminary findings of the trial are expected to be reported later this year.

The authors of this commentary believe that the reported case series in the literature are supportive evidence, but that randomized controlled trials to show the efficacy and safety of the procedure according to FDA guidelines are appropriate. Not only is such a method of study appropriate, it has begun. Leading practitioners are choosing to participate in the trial, and patients are enrolling in it – largely because of the design of the study and the ability to opt for crossover after an acceptable brief period of time following the initial treatment. The importance of the findings cannot be understated, and the importance of the trial should not be overlooked, both for the impact on vertebroplasty as a treatment for vertebral compression fractures, and influence on future trials of other interventions and surgical procedures.

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