POST-TRAUMATIC VERTEBRAL COMPRESSION FRACTURE TREATED WITH MINIMALLY INVASIVE BIOLOGIC VERTEBRAL RECONSTRUCTION

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Introduction:

- **High incidence of motor vehicle and sports injuries** among the active population in America causing symptomatic **painful post-traumatic vertebral compression fracture (PPT-VCF)**
- **29 cases** of **painful PPT-VCF** in this study
- These patients were **successfully treated** with **percutaneous vertebral augmentation (VA) for stabilization and reconstruction** with intervertebral **polyethylene mesh** (Optimesh, Spineology, Inc.), **biological morcelized bone graft**
Introduction:

- **Vertebral augmentation** is indicated for **painful VCF**
- **Vertebroplasty and kyphoplasty** have provided **excellent pain relief** but with **high incidence of leakage** of PMMA into spinal canal or vasculature, cardio pulmonary **complications** and adjacent vertebral fractures
- Since 2004 a **polyethylene mesh sac (OptiMesh®)** with morcelized bone graft has been used without above complications
- OptiMesh® provides excellent pain relief and fewer technical risks, is a **true biologic reconstruction** and is **osteo conductive and osteo inductive**
- Can also be used as an **intervertebral spacer** and for intervertebral **fusion/fixation**
Material and Methods

Demographics of VCF Treated (VA)

Thoracic 22 – Lumbar 9

- At our institute, since 2005, **29 patients** with symptomatic post traumatic vertebral compression fracture (VCF)
- Average **age of 51.8** (30 to 94)
- **Males: 18 Females: 11**
- Each failed at least 6 months of conservative care
- The **cause** for our post traumatic VCF are **various** including auto accidents, industrial injury, plane crash, falling and others
- Two **pre-existing osteoporotic elderly super imposed** on post traumatic cause
Material and Methods

- Post-traumatic VCF level of distribution (29 cases)
Introduction:

- The surgical approach provides an effective and controlled minimally invasive delivery system to stabilize and reconstruct VCF as well as avoiding complication from polymethylmethacrylate (PMMA) of vertebroplasty and kyphoplasty.
- The construct for biological bone graft and VA is osteoconductive and osteoinductive, used to create biological vertebral stabilization and reconstruction.
- The adjacent vertebra integrity is protected by the construct with a similar elasticity and physical characteristics of biologic morcelized bone graft, more matched to that of adjacent bone or vertebra than PMMA.
Introduction:

- **Goals of vertebral augmentation:**
  - Provides **stability** and strengthens the spine
  - **Correction** of vertebral body (VB) deformity
  - Significant **reduction** of pain
  - To improve **quality of life**
  - To improve ability to perform **daily living activity**
  - To **lower complication** rate (e.g. hip fracture, pneumonia etc...)
Surgical Indications

- Treatment criteria:
  - Symptomatic painful post-traumatic VCF or osteoporotic
  - Increased pain on upright and decreased on supine
  - Pain unrelieved by analgesics and narcotics
  - VCF due to post traumatic stable fracture, even osteoporosis, and others (aggressive hemangiomas, metastatic disease, osteogenesis imperfecta, trauma or vertebral osteonecrosis)
  - Multiple VCF’s and kyphosis resulting in pulmonary compromise
Contraindications

• Contra-indication in the following situations:
  
  – Painless asymptomatic stable VCF
  – Massive “burst” vertebral fractures
  – Osteomyelitis of target vertebra
  – Prophylactic treatment with no evidence of significant VCF
  – Unstable high risk patients
  – Retro pulsed fragment causing spinal canal compromise of 20% or more
  – Pathological fracture with tumor extending into spinal canal
Vertebral Augmentation
with an Intravertebral Mesh and Bone Graft

Granular mechanics:
morcelized ground bone chips

- Granules flow like liquids when uncontained
- Granules act like solids when contained
- Granular packs are porous even in their most rigid state
Vertebral Augmentation
Implant Device - Intravertebral Mesh and Bone Graft

OptiMesh® Implant:

- Three-dimensional, multi-strand, polyester mesh/sac
- Allograft containment and reinforcement system inside the OptiMesh®
- Grounded corticocancellous or morcelized bone chips inside the OptiMesh® device, hyper-dense graft pack
- Restoring height resulting in pain relief
Surgical Procedure/Technique:

Pre-op Prep Anesthesia

- **Local anesthesia** and monitored **IV conscious sedation**
- 2 grams Ancef and 8 mg dexamethasone IV pre-op
- **Surface EEG monitoring** (BIS)
- **IOM - EEG, EMG** to prevent undue neural trauma

Positioning and localization – surgical portal of entry

- Prone on radiolucent table
- C-arm must be able to swing arc

Lumbar

Thoracic
Guide Pin Placement:

- Parapedicular approach with the guide pin
- Under fluoroscopy guidance, the target position of “50/50 image” on AP and lateral view of vertebra
- Approximately 45° angle to contact the superior lateral quadrant of the pedicle at vertebral body junction
- Approximately 5-10cm from mid-line (thoracic 5-7cm and lumbar 8-10cm)
- Guide pin projectory toward and beyond desired target position of “50/50 image” under fluoroscopy
Dilator/Access Portal:

- Dilator inserted over pin
- Access portal inserted over dilator and impacted into bone
- Access Portal placed over Dilator and impacted into bone
- Adjust Stem to fit up to base of Access Portal
- The Drilling Dilator has markings for QuikTrak stem for size selection
Drill:

- Begins channel creation
- Drilling depth provides sizing information

Cavity Creation:
Mesh Insertion and Filling:

**Mesh inserted with cannulated holder and an extender**
- Apply gentle pressure to front of mesh with extender
- Insert till extender contacts distal side of cavity
- Release thumb pressure and push only on mesh holder
- Initiated with diverted tubes
- Tubes rotated to direct bone within mesh
- Mallet strikes drive graft out of tube
- Impaction grafting enables intravertebral graft expansion, endplate lift, and strut formation
Disengage Mesh from Tip:

- Two part crimp is disassemble with special tool
- Remove mesh holder and “lock tube puller” together
- Mesh is released
- Instruments are removed and wound closed
Case Illustration I

Post traumatic T7 vertebral compression fracture:

- 51 year old male with severe thoracic pain from post-traumatic T7 vertebral compression fracture/kyphosis
- Outpatient IV conscious sedation anesthesia for T7 OptiMesh® VA
- Immediate postoperative pain relief
- Discharged from outpatient surgical facility in two hours
Case Illustration I

Post traumatic T7 VCF:

T7 VCF

14.5 mm

27.7 mm
Case Illustration II

Post traumatic T4 vertebral compression fracture:

• 51 year old male with severe thoracic pain from post-traumatic T4 vertebral compression fracture/kyphosis as the result of a boat accident
• Outpatient IV conscious sedation anesthesia for T4 OptiMesh® VA
• Immediate postoperative pain relief
• Discharged from outpatient surgical facility in two hours

Thoracic T4 - VCF

Post OptiMesh®T4 Vertebral Augmentation

Cavity creation in VA
Case Illustration III

Post traumatic L2 vertebral compression fracture in a young man:

- 31 year old male sales manager with intratricable severe lumbar pain on activity from post-traumatic L2 vertebral compression fracture
- Outpatient conscious sedation anesthesia for OptiMesh® L2 vertebral augmentation
- Immediate postoperative pain relief
- Discharged from outpatient surgical facility in two hours
- Fourth post operative day travel to Asia

Post-op CT Scan and 3D Scan - Post OptiMesh® L2 Vertebral Augmentation

Post-traumatic L2 vertebral compression fracture in a young man:

L2 VCF

Post OptiMesh® L2 Vertebral Augmentation
Case Illustration IV

Post traumatic osteoporotic T7 VCF:

- 70 year old female manager with painful post-traumatic osteoporotic wedge compressive T7 fracture
- Outpatient conscious sedation anesthesia for OptiMesh® vertebral augmentation
- Immediate significant postoperative pain relief and returned to work in three days

Thoracic T7 VCF

Morcelized allograft or bone graft at T7 vertebra

CT – 50 days Post VA with osseous integration of bone graft
Surgical Outcome:

- Since 2005 Average follow-up **36 months** (5-72 mos)
- Overall pain relief: 26 (**93%**) patients with **good to excellent pain relief**, fair results 2(6.9%) patients
- **Response to treatment** evaluated by using: MacNab, modified Mac Nab criteria, ODI, VAS, patient satisfaction scoring, pain diagram and/or patient target achievement score (PTA)
- **High satisfaction score** – 28 (**96.6%**) patients
- 2 (**6.9%**) patients had **mild residual pain** and paraesthesia, although overall their pain lessened
- **No Complications** (infection, neurological symptoms and others)
- **0 adjacent level fracture**
- With **significant mean vertebral body restoration of height** – preoperative 54% to postoperative 84% and postoperative 6-12 month of 81%
Conclusion:

- Vertebral reconstruction via dilatation technology using the polyethylene mesh sac (OptiMesh®/bone graft) system provides an excellent minimally invasive, less traumatic, efficacious, safe and controlled stabilization (VA) to treat painful post traumatic VCF, and also degenerative osteoporotic VCF.
- This system is a true biologic reconstruction with osteo conductive and osteo inductive properties.
- Can also be used as an intervertebral spacer and lumbar fixation/fusion, and for decompression of lateral spinal stenosis.
References


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