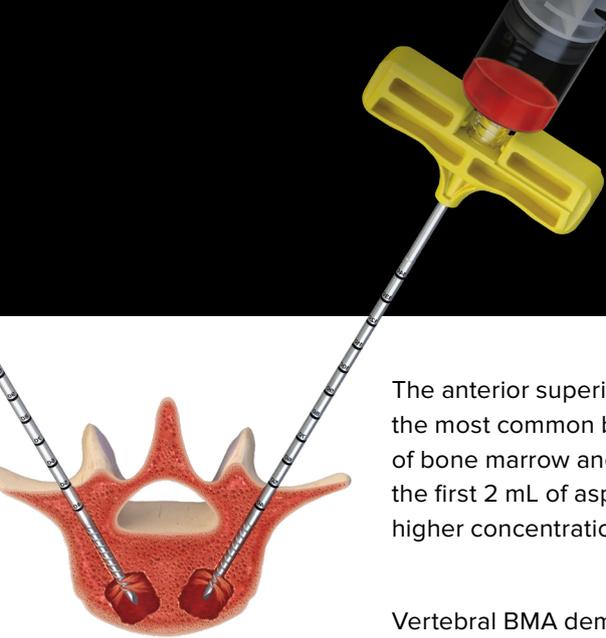


# Bone Marrow Aspiration Scientific Update



The anterior superior iliac spine (ASIS) and posterior superior iliac spine (PSIS) are among the most common bone marrow aspirate (BMA) harvest locations due to their high volumes of bone marrow and easy access during spinal fusion cases. Clinical evidence suggests that the first 2 mL of aspiration has the highest concentration of osteoprogenitor cells and that a higher concentration of cells can be harvested from the vertebral body than the iliac crest.<sup>1</sup>

Vertebral BMA demonstrated comparable or greater concentrations of CFUs than the previously set standards for BMA harvested from the iliac crest.<sup>1</sup> Further, the cancellous bone within the portion of the vertebral body—which is commonly cannulated during pedicle screw placement—allows for serial aspirations “with only modest depletion of progenitor cell concentrations and dilution with peripheral blood.”<sup>1</sup>

## Spinal Fusion

Nguyen TT,  
Fleischer GD

[Isolation of mesenchymal stem cells expressing BMPs from vertebra and iliac crest during spinal fusion.](#) *Spine J.* 2012;12(9):S21. doi:10.1016/j.spinee.2012.08.078

- Evaluation of quantity and osteogenic potential of mesenchymal stem cells isolated from bone marrow of cervical and lumbar vertebra, and iliac crest.
  - Bone marrow was obtained from either cervical and lumbar vertebra or the iliac crest
  - Mesenchymal stem cells (MSC) were subjected to osteoblast differentiation using osteogenic differentiation medium
  - Harvested cells differentiated into osteoblasts and expressed BMP-2 and BMP-7
  - Cells were tested for mineralization using intracellular BMP-2 and BMP-7 and osteoblast-specific marker osteocalcin by immunofluorescence
  - Outcome measure: nonclinical, basic science study

### Takeaway

MSCs (CD90/73p) are present in vertebral and iliac crest bone marrow. Progenitor cells may be locally harvested and used as a source of autologous stem cells in spinal fusion cases.

Hustedt JW,  
Jegade KA,  
Badrinath R,  
Bohl DD,  
Blizzard DJ,  
Grauer JN

[Optimal aspiration volume of vertebral bone marrow for use in spinal fusion.](#) *Spine J.* 2013;13(10):1217-1222. doi:10.1016/j.spinee.2013.07.435

- Prospective clinical study designed to determine the optimal bone marrow aspiration volume taken from the vertebral body
  - Data drawn from 18 pedicles and 180 aspirations
  - Subject pool comprised five men and seven women with an average age of 50.3 years
  - Outcome measure: nucleated cell count and alkaline phosphatase staining CFUs

### Takeaway

Authors found a direct relationship between increasing aspiration number and decreasing osteoprogenitor cell concentration. The 4th milliliter of aspirate had just 50% of the original aspiration's cell count.

McLain RF,  
Boehm CA,  
Rufo-Smith C,  
Muschler GF

Transpedicular aspiration of osteoprogenitor cells from the vertebral body: progenitor cell concentrations affected by serial aspiration. *Spine J.* 2009;9(12):995-1002. doi:10.1016/j.spinee.2009.08.455

- Sought to determine whether a concentration of osteoprogenitor cells comparable to the iliac crest (considered the gold standard) can be aspirated from different depths of the vertebral body along the same transpedicular axis.
  - Subject pool included six men and seven women with a mean age of 56 years (range: 40-74 years) undergoing elective posterior lumbar fusion and pedicle screw implantation
  - Outcome measure: cell count, CTP concentration (CTPs/cc marrow), and CTP prevalence (CTPs/million cells) were calculated for both individual and pooled aspirate samples

#### Takeaway

Marrow aspirated from vertebra showed comparable or greater concentrations of CFUs than the standard concentration set for the iliac crest. Serial aspirations of the cancellous bone in the area of the vertebral body routinely cannulated during pedicle screw placement can be completed without significant depletion of progenitor cell concentration and/or peripheral blood dilution.

#### Reference

1. McLain RF, Boehm CA, Rufo-Smith C, Muschler GF. Transpedicular aspiration of osteoprogenitor cells from the vertebral body: progenitor cell concentrations affected by serial aspiration. *Spine J.* 2009;9(12):995-1002