Vertebral Body Derotation

Surgical Technique
Introduction

DePuy Spine continues to support the goal of expanding the spine surgeon’s options for the treatment of spinal disorders. Collaborating with renowned spine specialists, DePuy Spine has developed this Surgical Technique Guide for Vertebral Body Derotation. This detailed Technique Guide includes step-by-step descriptions of Segmental as well as En Bloc vertebral body derotation manoeuvres.

The ins and outs of these techniques are described here with EXPEDIUM Spine System instrumentation and the Vertebral Body Derotation (VBD) Set. The EXPEDIUM VBD Set has been developed to address some of the challenges of the derotation manoeuvres. It provides intuitive tools that give the surgeon 360° control over anchor points and reduce the number of hands required for a multiple level derotation.

The EXPEDIUM family of products includes a wide selection of deformity specific implants and instruments to support the DePuy Spine philosophy of patient driven, pathology specific solutions.

Our hope is that this Surgical Technique Guide enhances your knowledge and contributes to clinical success for your patients.
Contents

Surgical Technique
Vertebral Body Derotation (VBD) 3
En Bloc Vertebral Body Derotation (Multiple Apical Levels) 6
Segmental Vertebral Body Derotation (Individual Vertebral Level) 9

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Surgical Technique
Vertebral Body Derotation (VBD)

Surgical Technique for Vertebral Body Derotation (VBD) using the EXPEDIUM Spine System in Scoliosis:

It is accepted that with the use of pedicle screws in Scoliosis Correction, significant coronal plane correction can be consistently obtained. True axial plane correction can now be achieved to address the rotational deformity of the spine, ribs and chest wall. The main goal of vertebral body derotation (VBD) is to achieve rotational deformity correction, which may decrease the need for thoracoplasty. (Figure 1)

The steps are as follows:
On the concave side: Insert Monoaxial, Uniplanar, or Polyaxial Screws at every level. Consider also using Polyaxial Reduction Screws at the apex of the concavity, particularly for severe curves.

On the convex side: Insert Monoaxial, Uniplanar or Polyaxial Screws into at least 3-4 convex pedicles at the apex, as well as the proximal and distal foundations.

Confirm placement of screws and check screw length with fluoroscopy or plain X-rays prior to rod insertion.
Vertebral Body Derotation (VBD)

Contour the concave rod with extra kyphosis (anticipating that the rod will become flatter during the translation/reduction of the scoliosis) to pull the apical vertebrae dorsally out of chest, and correct apical lordosis. (Figure 2)

Contour the convex rod with less thoracic kyphosis to push down on the convex side of the vertebral bodies, thus displacing them anteriorly and decreasing the rib prominence. (Figure 2)

Note: The rod's mechanical properties will be an important factor in kyphosis restoration and derotation. The stronger rods in the EXPEDIUM portfolio (i.e., High Strength SS, Ultra High Strength SS and CoCr Alloy rods) will be more effective than the Standard SS and Ti rods in axial derotation and sagittal plane restoration, since less flattening of the rod can be expected. The rod strength, however, should be matched to the patient's bone density.

Insert the concave rod into the pedicle screw anchors leaving the set screws loose. (Figure 3)
Vertebral Body Derotation (VBD)

The rod can engage the anchors via one or both of the following:

a. Translation Manoeuvre: Insert the rod proximally and distally and tighten the connectors proximally and distally, leaving the rod in the correct sagittal plane.

After proximal and distal foundations are connected and locked, apical screws are translated to the rod segmentally by using reduction devices or reduction screws. (Figure 4a)

b. Rod Rotation Manoeuvre: Insert the rod and perform a rod rotation manoeuvre as in the classic CD Technique. In this case, the rod rotates from the midline scoliotic position laterally to the left. (Figure 4b)

During the 90° rotation one must have control over the convex ribs by pushing down to avoid aggravating the rib prominence.

Finally, proceed with one or both of the Vertebral Body Derotation techniques explained in the following section.
En Bloc Vertebral Body Derotation (Multiple Apical Levels)

After the concave rod is engaged in all anchors, attach VBD instruments: EXPEDIUM Derotation Quick Sticks, Facilitators, Flex-Clip with Rotation Tube or VIPER® 2 Screw Extensions, (Figure 5a-d) to apical screw heads on both concave and convex sides. (Figure 6)
En Bloc Vertebral Body Derotation (Multiple Apical Levels)

An assistant pushes down on the convex ribs and the convex screws while the concave and convex screws are rotated in the direction that will reduce the rib prominence (counterclockwise in Figures 6 & 7). This should be done simultaneously to distribute strain and to limit loading of the bone-screw interface. The rotation of the concave screws will help decrease the torsion and will lift the concavity out of the chest. (Figures 6 & 7)

A rehearsal of this manoeuvre prior to rod insertion can be helpful to gain a sense of how much force is to be applied safely.
En Bloc Vertebral Body Derotation (Multiple Apical Levels)

Lifting the concave side out of the chest is effectively done with the Quick Sticks locked on the TOP NOTCH™ feature of EXPEDIUM implants. This feature provides 360° control of the anchor point without the need for additional instrumentation.

In addition, using the EXPEDIUM Derotation Frame and/or Alignment Fork, multiple Quick Sticks can be linked together and rotated in unison (Figure 8).

*Note: Some surgeons believe that the VBD manoeuvre with both rods in place minimises the loss of rotational correction that occurs from spine “spring back” when inserting and rotating one rod at a time. In this case, follow the same steps described above but with both rods already implanted.*

Tighten the set screws on the concave rod holding this position. (Figure 9a)

Implant the convex rod and tighten the set screws on the convex side. (Figure 9b)
Segmental Vertebral Body Derotation (Individual Vertebral Level)

Segmental Vertebral Body Derotation can be done as the sole derotation manoeuvre or in addition to the En Bloc manoeuvre described before.

Implant both rods and capture them with the set screws. Most set screws should be left loose since lengthening of the spine is expected at each level that will be segmentally derotated. Only the set screws in the distal neutral vertebra should be tightened (e.g., L1 in Figure 10a).

Attach two Quick Sticks in the distal segment to lock the bottom neutral vertebra (Figures 10a, b). Then attach Quick Sticks in the next proximal 1-2 vertebrae. The Quick Sticks on the distal vertebra must be held by an assistant to provide counter-rotation force.
Segmental Vertebral Body Derotation (Individual Vertebral Level)

Derotate each proximal vertebral body to achieve a neutral position in reference to the neutral distal vertebra (Figure 11a, b). After derotation of each segment, the set screws are tightened. Repeat this process, moving along towards the apex.

Complete neutral derotation may not be achieved at the apex relative to its torsion in the axial plane during the first pass. Repeating the derotation manoeuvres at some levels can be helpful due to viscoelastic relaxation of the spine. Care must be taken not to loosen the bone-screw interface while performing the manoeuvre.

The EXPEDIUM Derotation Quick Sticks, Facilitators, Flex-Clip with Rotation Tube or VIPER 2 Screw Extensions, are all effective in this step of Segmental Derotation. (Figure 5a-d)

In addition, using the EXPEDIUM Derotation Frame, Quick Sticks in the same vertebral level can be linked together and rotated in unison. (Figure 10b)

Repeat the derotation for each segment, until all vertebral levels nearly match the neutrally rotated distal vertebra.

During Segmental Spinal Derotation, segmental compression (convexity) and/or distraction (concavity) may be simultaneously applied to effect maximal correction, just before the set screws are tightened.

Additional coronal correction can be achieved with the use of EXPEDIUM Coronal In-situ Benders. In-situ contouring is more easily achieved when using standard SS rods than when using High and Ultra Strength Rods (Figure 12).
Indications
The EXPEDIMUM Spine System is intended to provide immobilisation and stabilisation of spinal segments in skeletally mature patients as an adjunct to fusion in the treatment of acute and chronic instabilities or deformities of the thoracic, lumbar and sacral spine.

The EXPEDIMUM Spine System is intended for noncervical pedicle fixation and nonpedicle fixation for the following indications: degenerative disc disease (defined as back pain of discogenic origin with degeneration of the disc confirmed by history and radiographic studies); spondylolisthesis; trauma (i.e., fracture or dislocation); spinal stenosis; curvatures (i.e., scoliosis, kyphosis, and/or lordosis); tumour; pseudoarthrosis; and failed previous fusion in skeletally mature patients.

Limited Warranty and Disclaimer
DePuy Spine products are sold with a limited warranty to the original purchaser against defects in workmanship and materials. Any other express or implied warranties, including warranties of merchantability or fitness, are hereby disclaimed.

WARNING: This product has labeling limitations. See package insert for complete information.