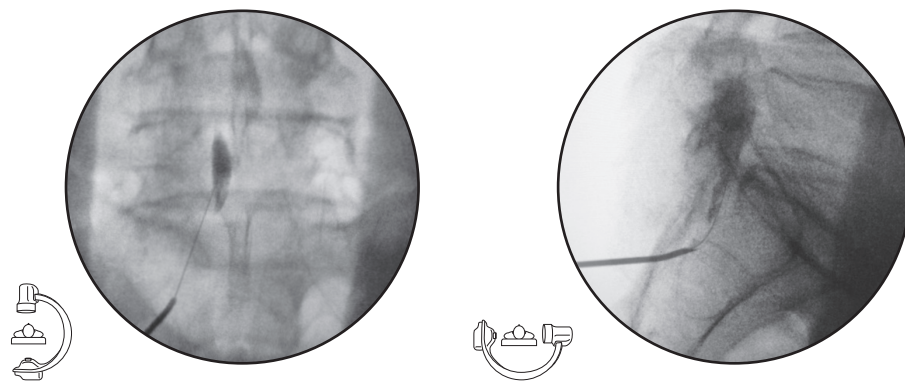


1. Connect the Stingray® Connector and inject 5-10 cc of OMNIPAQUE™ 240 within the scarred area. Injection of contrast may require significant pressure for a complete spread due to its viscosity. It will open up the ventral epidural space, slowly crossing over, and spread from L4 down to S2 bilaterally.
2. Inject a mixture of 10 cc of preservative-free saline and 150 units of Hylenex®; this will disperse the contrast. Carefully observe for a potential spread into the subdural and subarachnoid spaces, especially in failed surgery cases where the possibility of a dural tear may exist.
3. Slowly inject a mixture of 10 cc of 0.2% ropivacaine and 40 mg triamcinolone. Ask the patient to move their feet and to report any pain at any time other than during injection. Subdural injectate accumulation in the scarred area may produce bilateral pain and have atypical appearance. If subdural loculation occurs, it can be aspirated with an interlaminar needle placement.
4. After local anesthetic injection, observe the patient for 20-30 minutes and make sure they are able to perform a 90 degree straight leg raise without any evidence of motor block.
5. Infuse 10% NaCl over a 15-minute period. Then flush with local anesthetic or normal saline at completion.
6. If the patient develops a motor block, he or she may need to be admitted into the hospital for observation.
7. A one-time injection into the scarring triangle is effective for a short period of time; however, three repeat injections, 6-8 hours apart, have been reported as more effective for many months to over a year.
8. Instruct the patient to perform neural flossing exercises to the patient for the sciatic area. There are also separate instructions for the upper lumbar area.



## Literature and Scientific Articles

### Trans S1 Infralaminar Scarring Triangle Step by Step: Poster Presentation ASIPP 21st Annual Meeting, Las Vegas, NV, May 2019

1. Teske W, Zirke S, Nottenkamper J, Litchtinger T, Theodoridis T, Kramer J, Schmidt K. Anatomical and surgical study of volume determination of the anterolateral epidural space nerve root L5/S1 under the aspect of epidural perineural injection in minimal invasive treatment of lumbar nerve root compression. *Eur Spine J* (2011) 20:537-541
2. Matsumoto T, Kitagawa H. Treatment of lower back and leg pain using Racz Catheter-Matsumoto Way (via S1 intervertebral foramen). Poster Presentation. 2014 WIP World Congress Maastricht
3. Heavner J, Racz G, Raj P. Percutaneous Epidural Neuroplasty: Prospective Evaluation of 0.9% NaCl Versus 10% NaCl With or Without Hyaluronidase. *Regional Anesthesia and Pain Medicine* 1999; 24(3): 202-207
4. Krämer J, Ludwig J, Bickert U, Owczarek V, Traupe M. Lumbar epidural perineural injection: a new technique. *Eur Spine J*. 1997;6:357-361.
5. Ng L, Chaudhary N, Sell P. The efficacy of corticosteroids in periradicular infiltration for chronic radicular pain. *Spine*. 2005;30(8):857-862.
6. Theodoridis T, Krämer J. *Spinal Injection Techniques*. (2009) Thieme Verlag, Stuttgart
7. Racz GB, Heavener JE. In: Racz GB, Noe CE, eds. *Introduction to Lysis of Adhesions. Techniques of Neurolysis, 2nd Edition*. Switzerland: Springer; 2016; Chapter 1: 1-12

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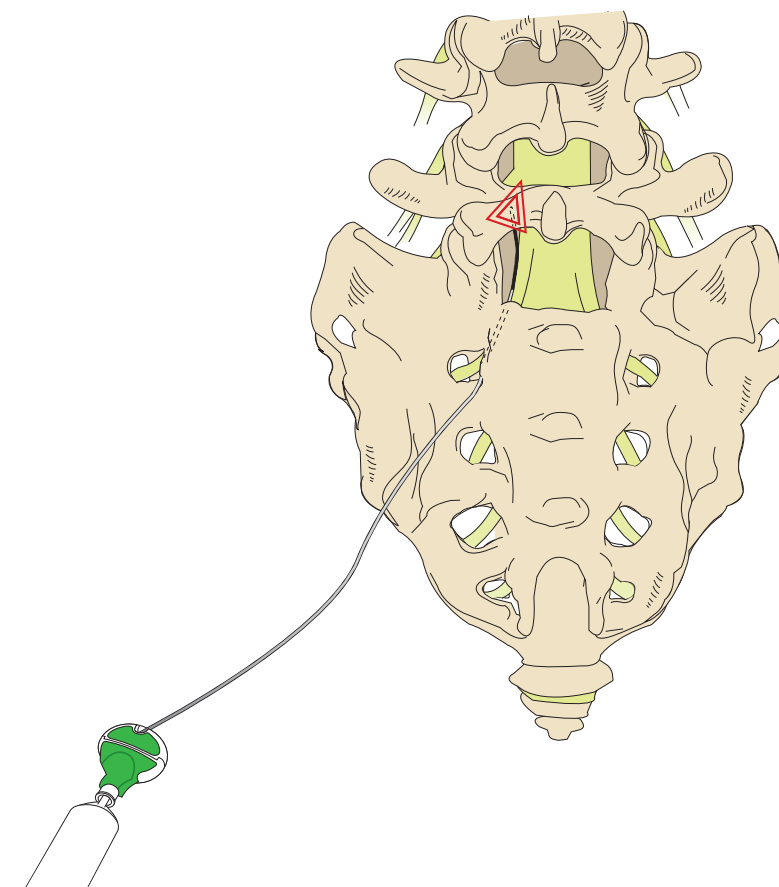
**NOTE:** Although this step-by-step guide is based on the technique and clinical experience of a physician, the information contained in this guide is for general guidance on matters of interest only and shall not be substituted for or assimilated to legal or medical advice. You should always consult current literature for appropriate techniques, volumes, and medications used for injections and procedures.

Before using any medical device, read all the instructions for use supplied with the product. This guide and its contents are not a substitute for the operator's manual of any medical product, which include important warnings and precautions. This white paper does not instruct on the proper medical use of this equipment. It is the responsibility of the physician and/or support staff using the described equipment to decide the suitability of the procedure for each patient, and to refer to current literature for appropriate techniques, volumes, and medications used for injections and procedures.

# TRANS S1 INFRALAMINAR SCARRING TRIANGLE

## A Step-By-Step Technique Guide

A White Paper Series by Gabor B. Racz M.D., DABPM, FIPP, DABIPP



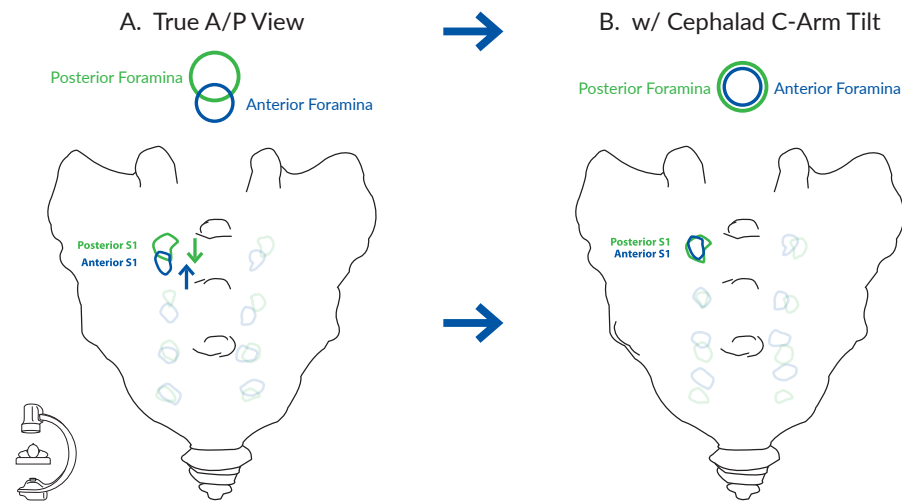
## Introduction

A unique triangular space has been identified by Teske *et al.*, measuring 0.9-1.1 mL on each side.<sup>1</sup> The boundaries are medial to the L5 nerve root, lateral to the S1 nerve root and the base of the triangle is above the disc of L5- S1. This space is large enough to accept the average loose disc fragment. This space tends to collect leaky disc material, a common result of trauma and surgery. Due to the curvature of the sacrum and the formation of dense scarring, regular epidural catheters and scopes have not been able to enter this scarred epidural area. Matsumoto *et al.*, realized that entering from the posterior aspect of the S1 neural foramin with an 18 gauge RX-2™ Coudé® Needle and then rotating it, the curved tip allows for ventral epidural projection of a 21 gauge VERSA-KATH®.<sup>2</sup> The VERSA-KATH® is x-ray visible, and it is also steerable as long as rotation coincides with the advancement of the catheter.

The scarring triangle is located in-between the L5 DRG and the S1 nerve root and above the L5-S1 disc. Dense scarring can present clinically as: ipsilateral back pain (due to the dura and posterior longitudinal ligament adhering together), L5 radiculopathy, numbness and dysesthesia in the lateral calf to the lateral ankle and foot, and weakness on dorsal flexion of the foot. In advanced cases, foot drop may be evident. Opening of the scarring triangle with the recommended volumes can reverse these clinical symptoms. An S2 component will present as radiculopathy along the posterior aspect of the thigh and calf. Stretch-induced ischemia of the involved nerve roots is likely the cause of foot drop and can be reversed following the scarring triangle neuroplasty.

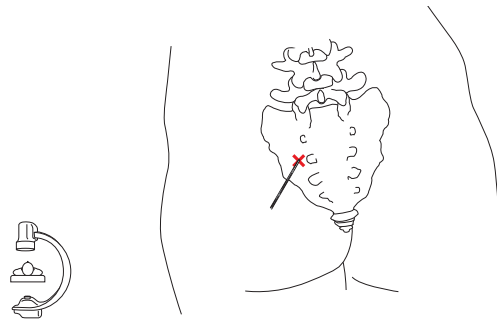
## Process

### 1 Alignment of Neural Foramina Using C-Arm



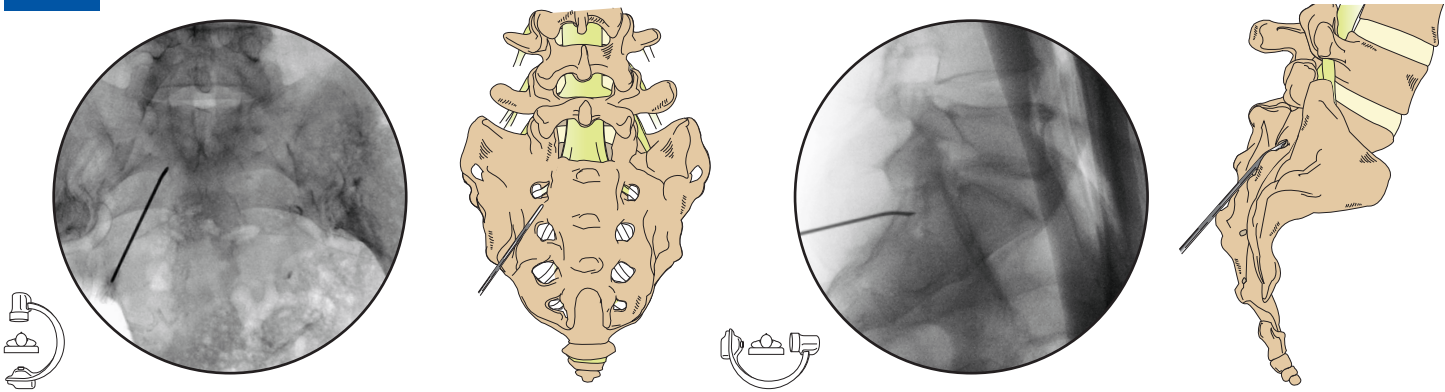
Place patient in prone position. Fluoroscopically, with a true A/P view (A), the 4 sacral neural foramina will be seen as 8 foramina because of the curvature of the sacrum. The posterior neural foramina will be seen more cephalad while the anterior foramina will be seen more caudal. To align the neural foramina, rotate the c-arm in a cephalad direction until the S1 ventral and dorsal neural foramina line up (B). The 18 gauge needle has a curve near the tip, but one still needs a gentler angle to allow cephalad advancement of the catheter. The starting point will be the lateral side of the S2 posterior neural foramen.

### 2 RX Coudé® Needle Entry Site and Placement



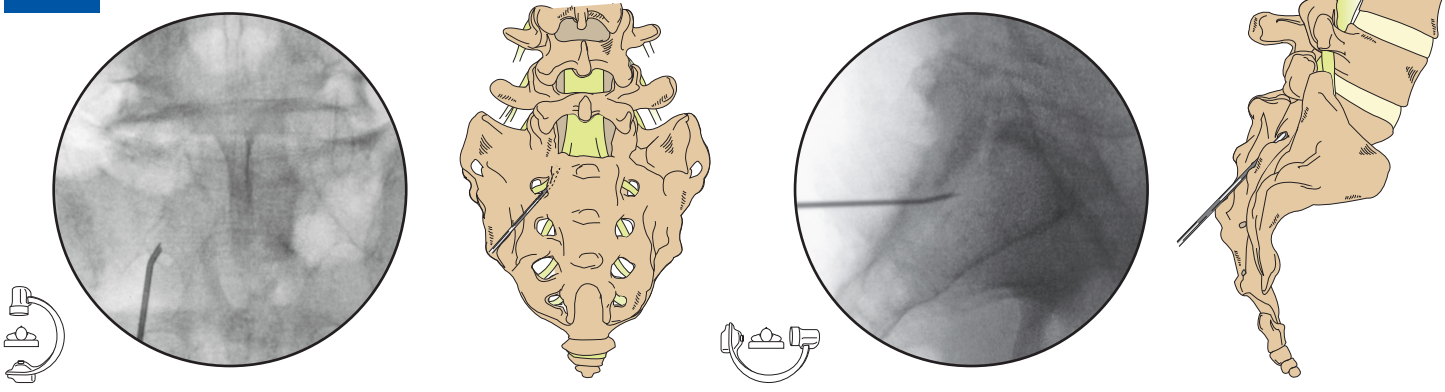
The needle entry point is from the S2 aiming towards the medial side of S1. Apply topical anesthesia and advance the needle through the skin.

### 3 RX Coudé® Needle Advancement



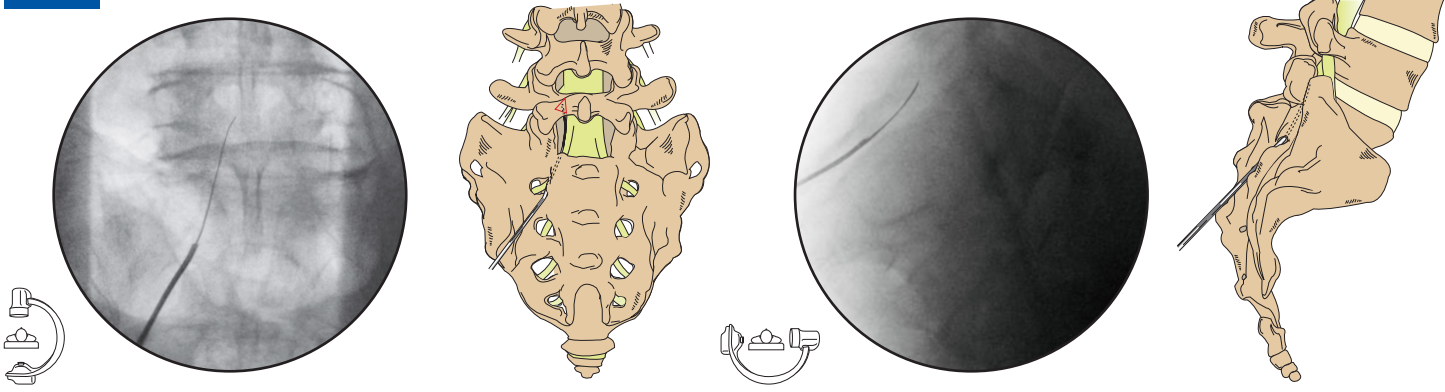
Curve the needle down to and contact bone between the S1 and S2 on the sacrum. After contact is made, continue to advance until a penetrative “pop” is felt, indicating foraminal entry.

### 4 Introduction of Blunt Stylet



Remove the original stylet and interlock the atraumatic, blunt stylet. With the aid of lateral fluoroscopic visualization, rotate the needle tip dorsally and medial. Position the c-arm with a cephalad tilt to reduce radiation exposure to the operator's hand, leaving only the needle tip visible.

### 5 Catheter Placement



Advance the styletless VERSA-KATH® into the sacral canal under fluoroscopic visualization after removing the second stylet. The catheter needs to cross the L5-S1 disc space and advance into the fibrotic tissue (scar) near the top of the L5 neural foramen. The catheter should not advance medial or lateral inside the imaginary triangle between L5 and S1. For more accurate placement, the VERSA-KATH® can be rotated during advancement.