Interventional Cryoneurolysis

J. David Prologo, MD, FSIR, ABOM-D
Associate Professor
Emory University School of Medicine
Department of Radiology and Imaging Sciences

Disclosures

- Chief Medical Officer — Focused Cryo, Inc.

Is Cryoneurolysis New?

ELSEVIER

The Annals of Thoracic Surgery

Volume 18, Issue 3, September 1974, Pages 280-285

Intraoperative Intercostal Nerve Freezing to Prevent Postthoracotomy Pain

K.M. Nelson M.D., R.G. Vincent M.D., R.S. Bourke M.D., D.E. Smith M.D., W.R. Blakeley M.D., R.J. Kaplan M.D., M. Pollay M.D.

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https://doi.org/10.1016/S0003-4975(10)64357-3

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Abstract

Intraoperative intercostal nerve freezing has been found to improve coughing and deep breathing and reduce the need for narcotics postoperatively. The incision is rendered anesthetic, and the procedure does not require repetition. This technique avoids the possible

So What Is Different?

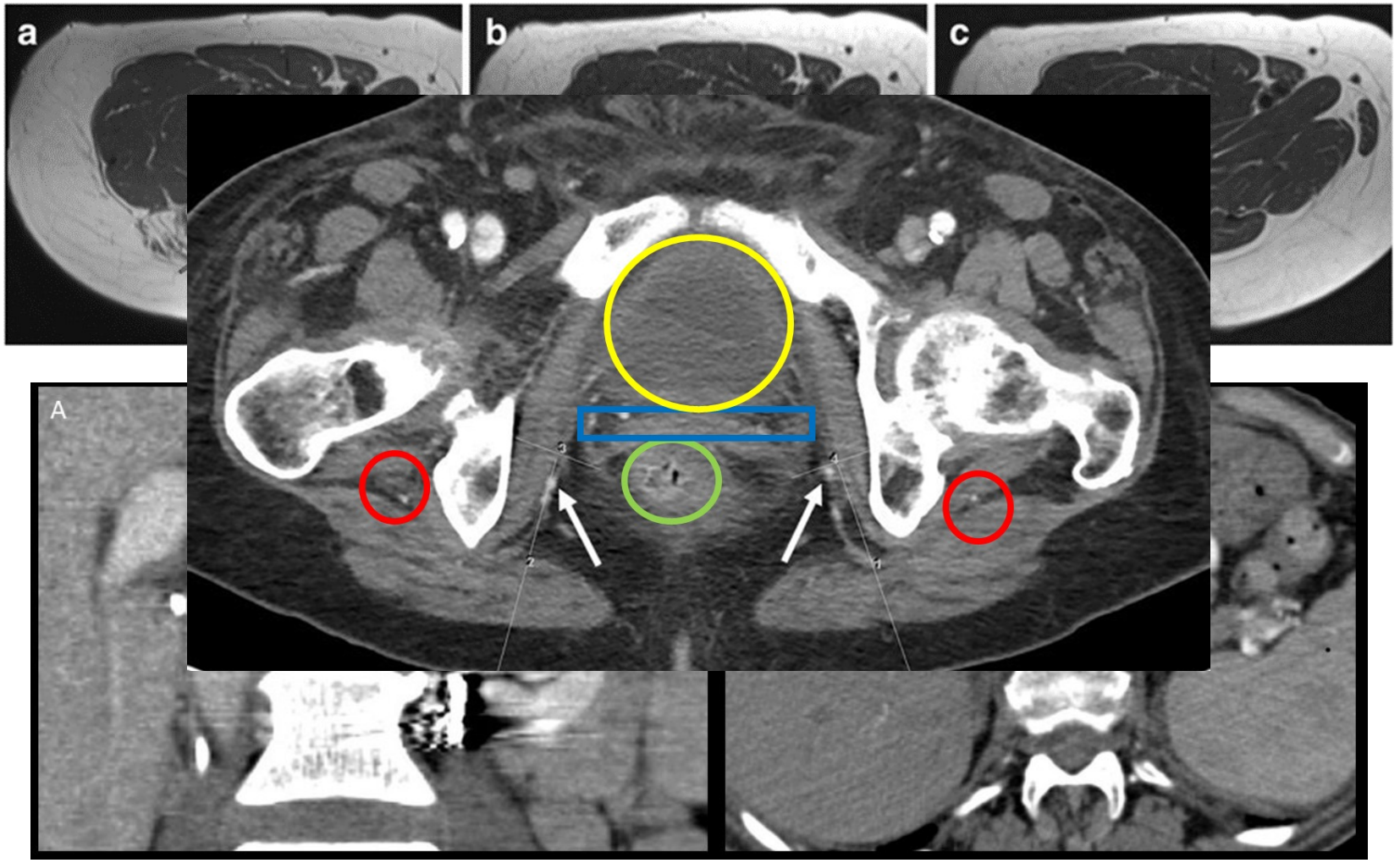
- Three things

Advanced Imaging Guidance

Neurohistology

Regeneration

Advanced Imaging Guidance

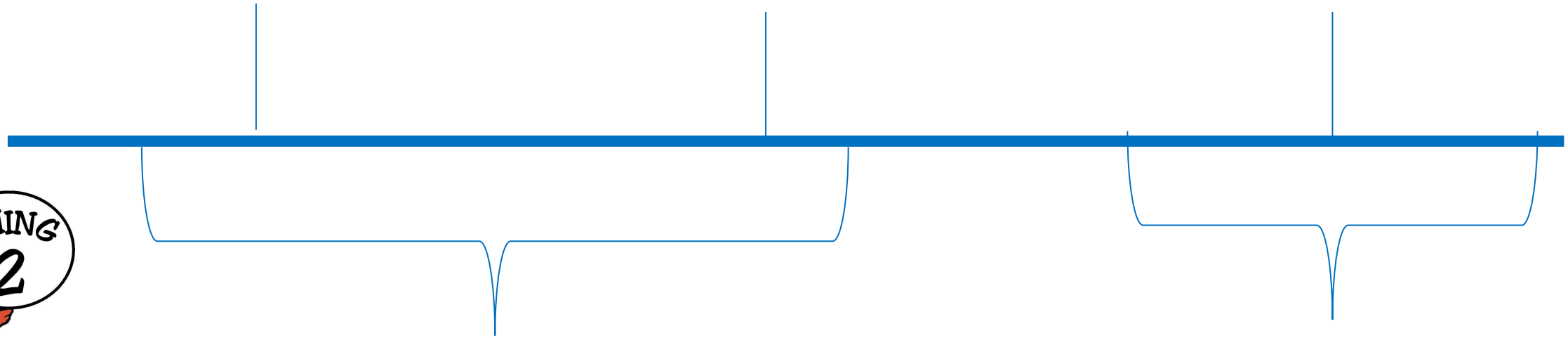


Temperature Mediated Injury to Nerves

+10º C
Temporary signaling inactivation

-5º C
Conduction block lasting hours - days

-20º C
Axonotmesis



Na/K pump disruption

Axonal and Myelin degeneration

Neurohistology

Seddon	Sunderland	MacKinnon	Description
Neuropraxia	1		Local physiologic block with paralysis but no anatomic disturbance of the nerve. Full recovery is expected
Axonotmesis	2		Nerve injury with degeneration of the distal segment. Intact endoneurium and perineurium. Full recovery occurs at rate of 1.5 mm/day
	3		Endoneurial damage with subeequent scarring and incomplete regeneration. Variable recovery
Neurotmesis	4		Nerve damaged with complete internal structural disorganization. Nerve trunk remains intact. No functional recovery unless operative intervention
	5		Nerve trunk cut completely. Early operative intervention necessary for restoration of some function
		6	Mixed nerve injury

Trescot AM. *Pain Physician.* 2003;6(3):345-60.

Neurohistology

Depth

Blood Flow

Nerve Size and Composition

Time

Lesion Length

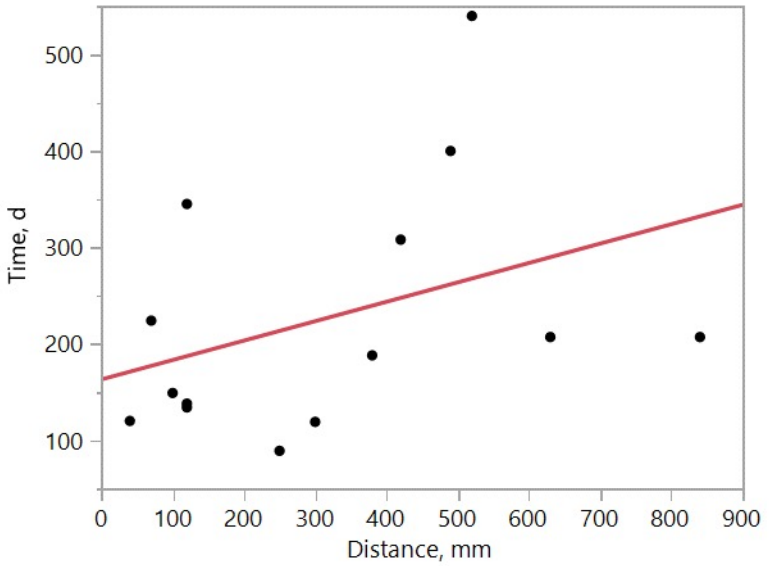
Table 1. Nerve injury as a function of cold [5,7].

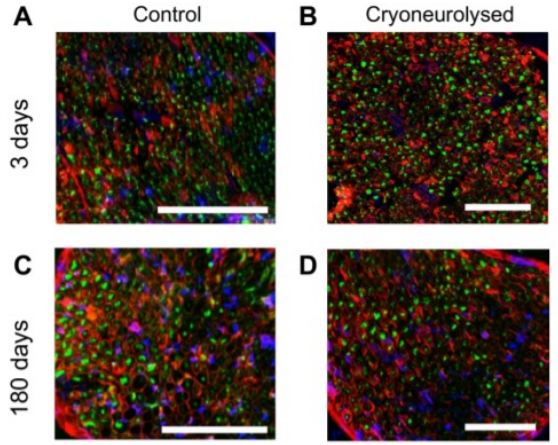
Reversible	
First degree	+10 to −20°C
Neuropraxia – interruption of conduction; short recovery time	
Second degree	−20°C to −100°C
Axonotmesis – Loss of axon continuity; Wallerian degeneration; preservation of endoneurium, perineurium and epineurium	
Nonreversible	
Third/Fourth degree	−140°C and colder
Neurotmesis – loss of axon continuity; some loss of continuity of endoneurium and perineurium	
Fifth degree	Not possible with cryoneurolysis
Transection (severe neurotmesis) – gross loss of continuity	

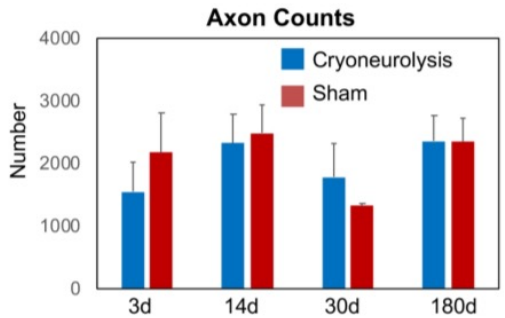
Ilfeld BM, Preciado J, Trescot AM. *Expert Rev Med Devices*. 2016;13(8):713-25.

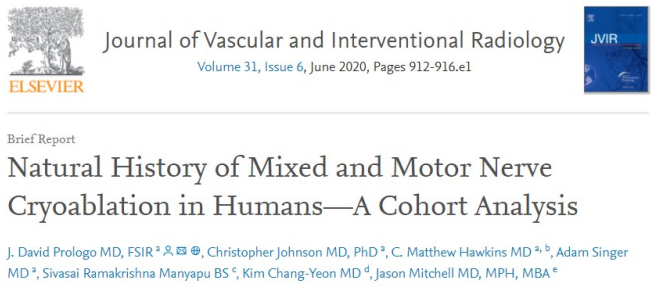
Regeneration

Regeneration









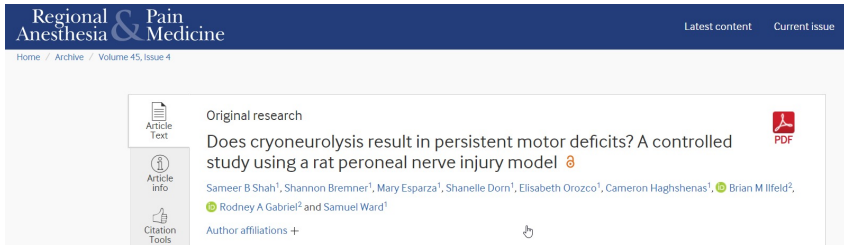
Journal of Vascular and Interventional Radiology

Volume 31, Issue 6, June 2020, Pages 912-916.e1

Brief Report

Natural History of Mixed and Motor Nerve Cryoablation in Humans—A Cohort Analysis

J. David Prologo MD, FSIR [a], Christopher Johnson MD, PhD [a], C. Matthew Hawkins MD [a, b], Adam Singer MD [a], Sivasai Ramakrishna Manyapu BS [c], Kim Chang-Yeon MD [d], Jason Mitchell MD, MPH, MBA [e]



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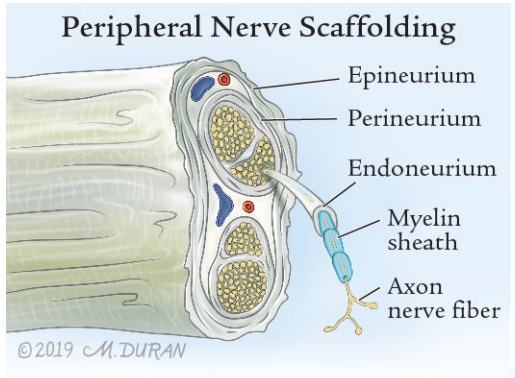
Original research

Does cryoneurolysis result in persistent motor deficits? A controlled study using a rat peroneal nerve injury model

Sameer B Shah[1], Shannon Bremner[1], Mary Esparza[1], Shanelle Dorn[1], Elisabeth Orozco[1], Cameron Haghshenas[1], Brian M Ilfeld[2], Rodney A Gabriel[2] and Samuel Ward[1]

Author affiliations +



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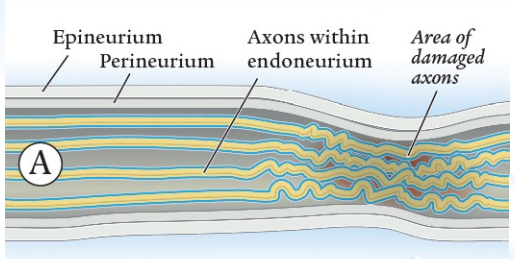
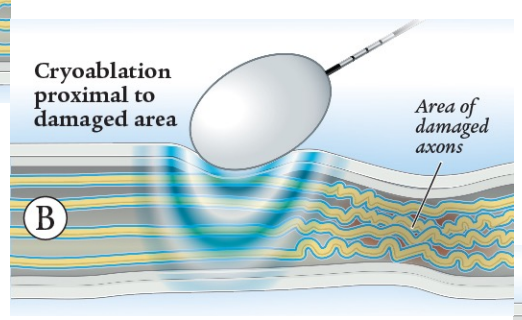
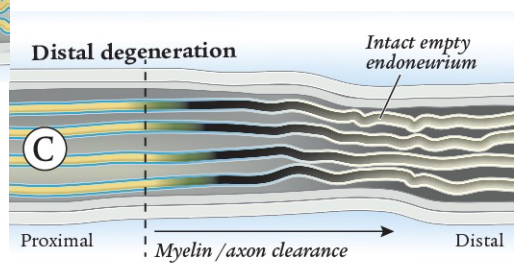
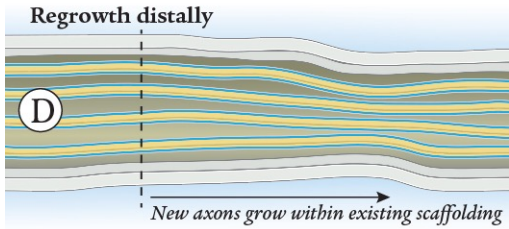
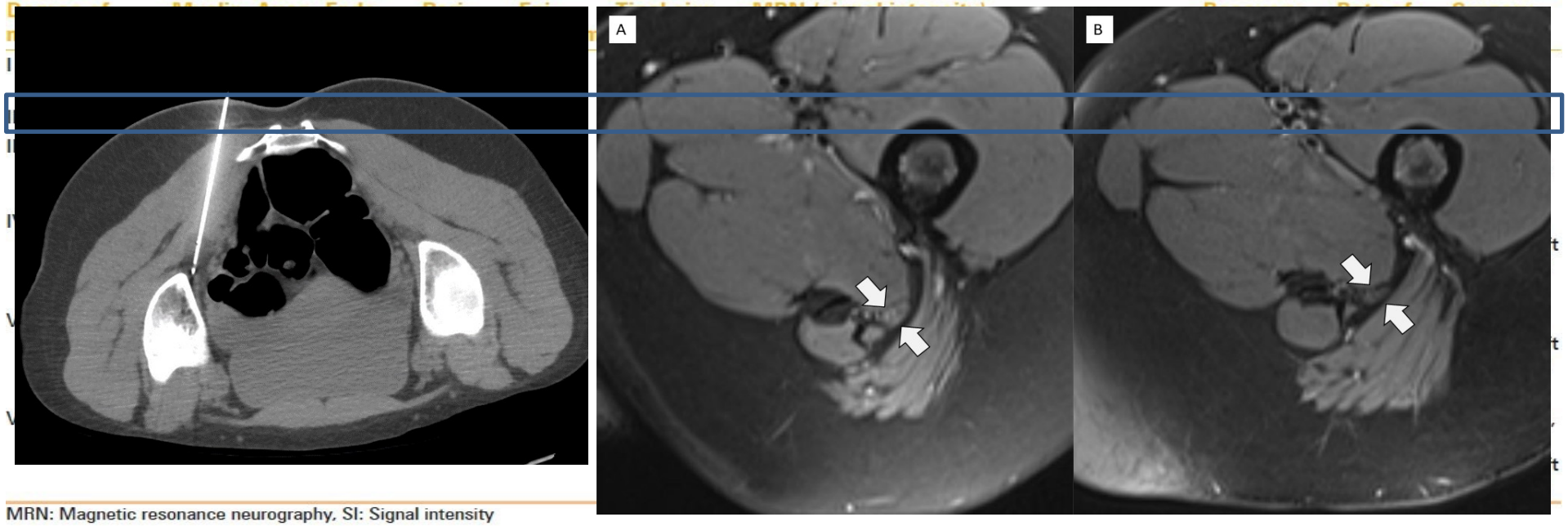










MRN: Magnetic resonance neurography. SI: Signal intensity

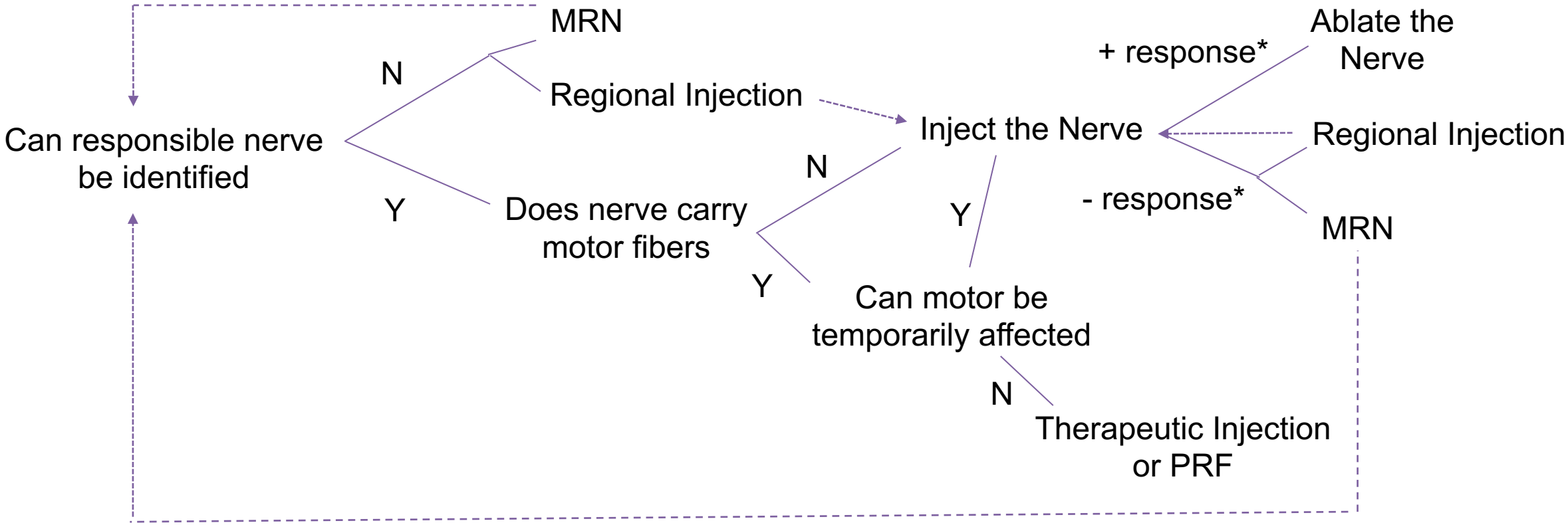
Indian J Radiol Imaging. 2014 Jul-Sep; 24(3): 217–224.
doi: 10.4103/0971-3026.137025
PMCID: PMC4126136
PMID: 25114384

Peripheral nerve injury grading simplified on MR neurography: As referenced to Seddon and Sunderland classifications

Avneesh Chhabra, Shivani Ahlawat,[1] Allan Belzberg,[2] and Gustav Andreseik[3]

How this Works (Non-Oncology)

* 50% better, or 3 points on the VAS



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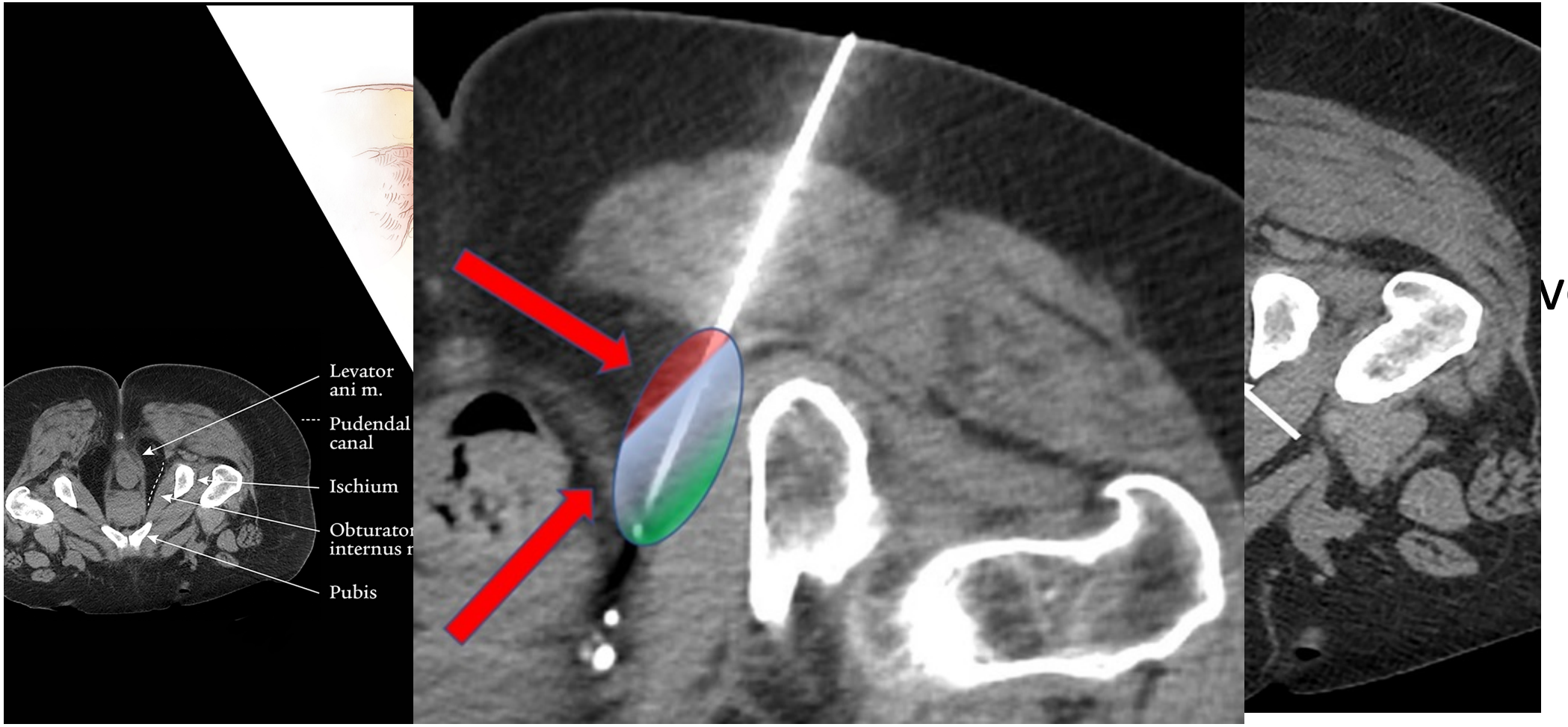

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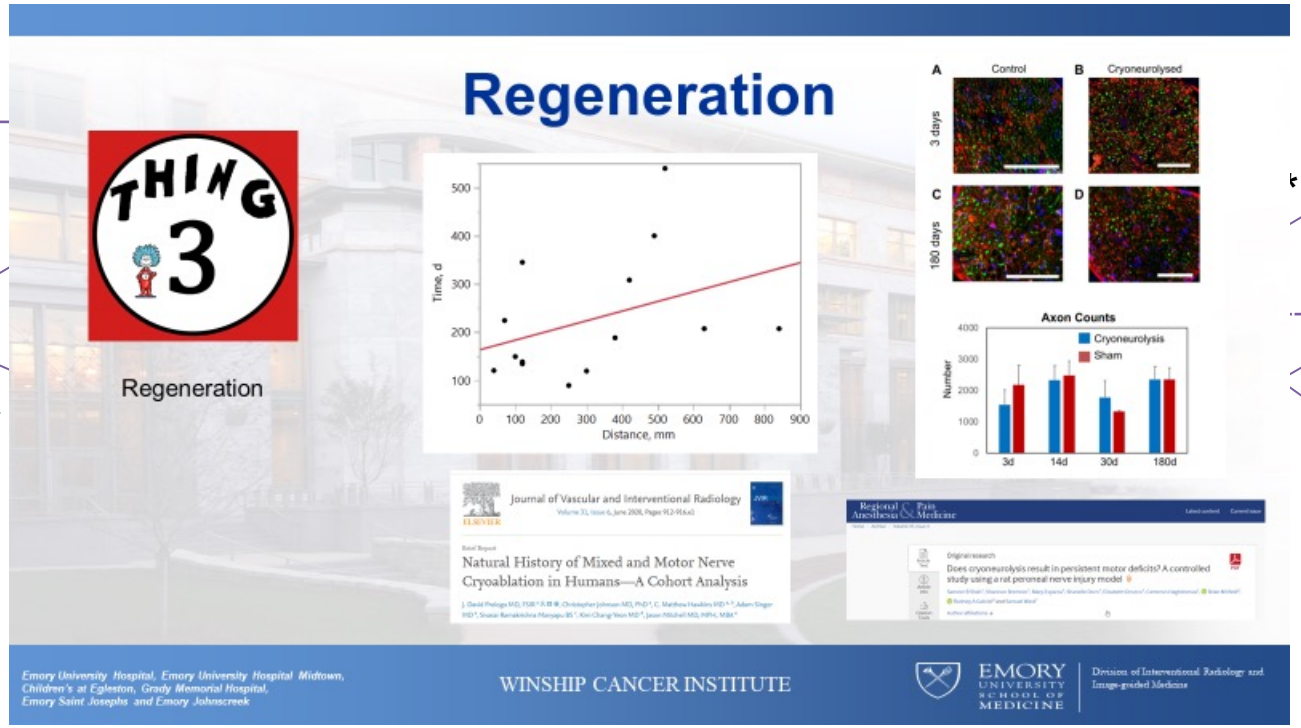
How this Works (Non-Oncology)

* 50% better, or 3 points on the VAS

Can responsible nerve be identified

N

Y



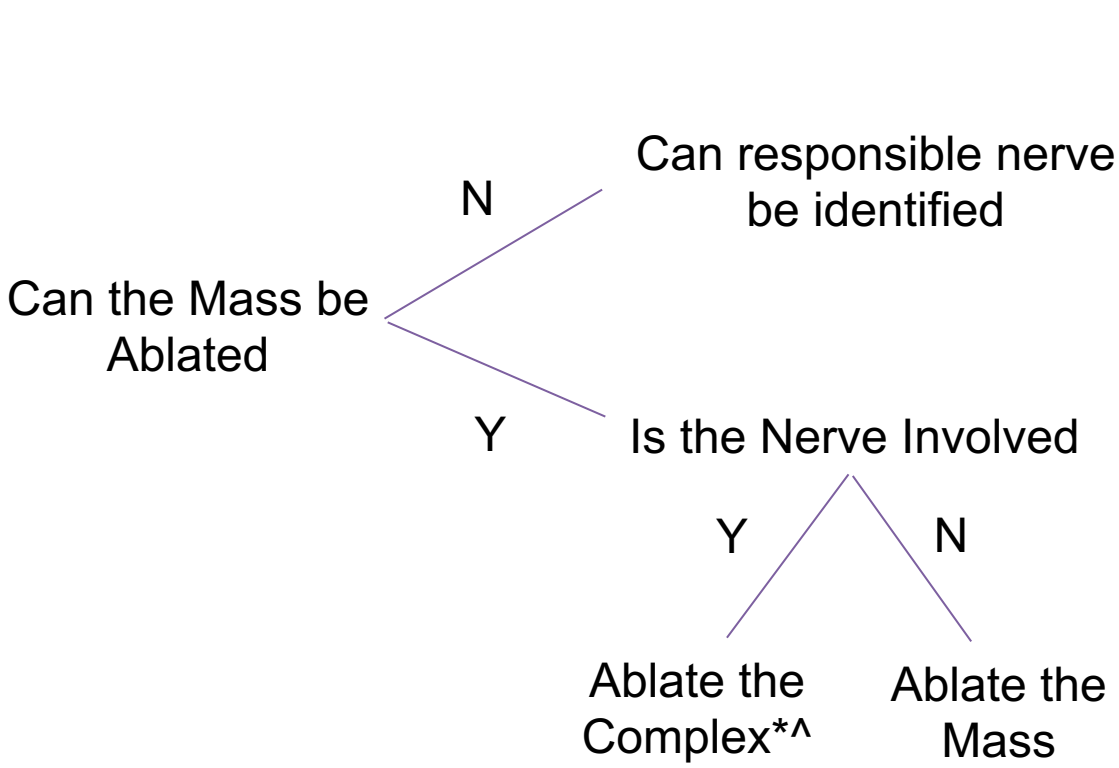
Ablate the Nerve

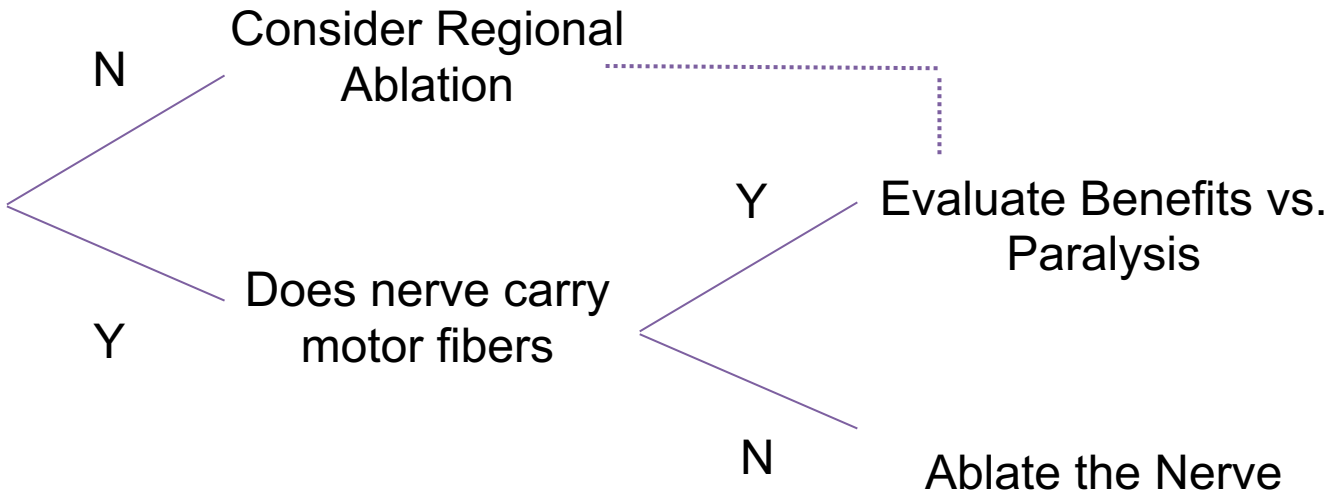
Regional Injection

MRN

Therapeutic Injection or PRF

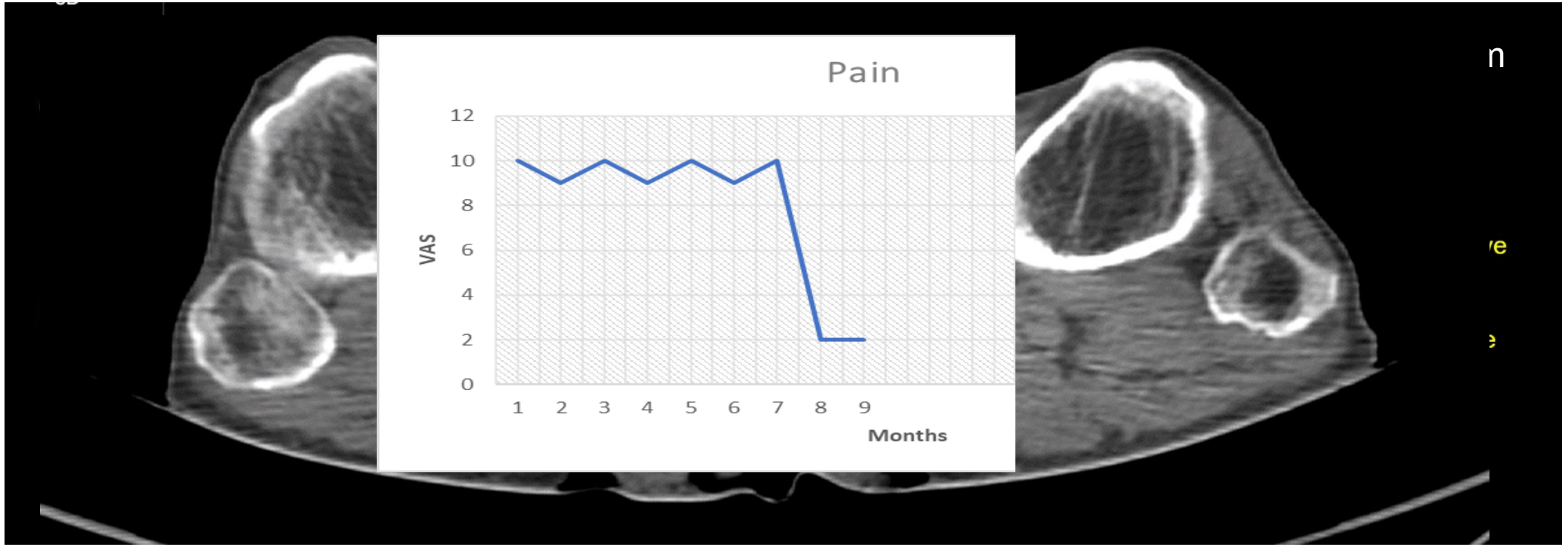
How this Works (Oncology)





- Include nerve with tumor protocol
- Evaluate potential effects of motor compromise

How this Works (Oncology)



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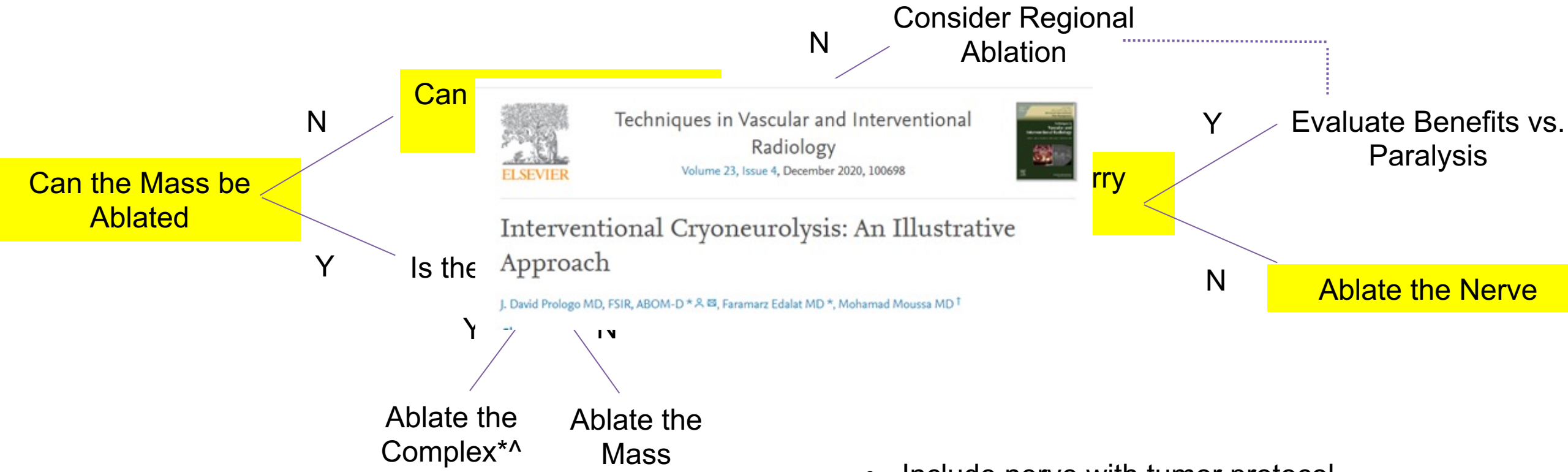

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Thank You