Vessel Staining Patterns and Intervention Effects in Complex Regional Pain Syndrome via Angiography

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Introduction

➢ Complex Regional Pain Syndrome(CRPS)

- Previously known as Reflex sympathetic dystrophy, Sudeck's atrophy, neuro-algodystrophy, etc
- Chronic pain condition allodynia and hyperalgesia
- Frequently develops after trauma or surgery
- Heterogenous disease with inflammatory, autoimmune, sympathetic, and neuropathic features
- Classification
  - ✓Type I : without obvious nerve damage
  - ✓Type II : with obvious nerve damage

➢ CRPS pathophysiology

- Still under discussion
- Peripheral and central nervous system
  - ✓Classic inflammation, neurogenic inflammation, peripheral & central sensitization
- Sympathetic afferent coupling
  - ✓Abnormal interaction, dysregulation in sympathetic nervous system and blood vessels
  - ✓Vascular structural change

➢Diagnostic tests for CRPS

- Diagnostic criteria : Budapest criteria (2010), 'New' IASP criteria (2012)
- No gold standard radiological, laboratory, genetic, or electrical diagnostic test for CRPS
- Imaging and autonomic testing : support CRPS diagnose, exclude alternative causes
  - ✓Three phase bone scan, X-ray
  - ✓Autonomic testing : Digital infrared thermographic imaging, Resting sweat output, QSART
  - ✓NCS/EMG, BMD
  - ✓Differential diagnose : MRI, SPECT/CT

➢ Purpose of this study

- To verify sympathetic afferent coupling
  : Determine a comparison of TPBS, DITI and angiographic results
- To confirm treatment values of angiographic intervention in patients with CRPS

Method

➢ Patients characteristics

	Age	Sex	Primary Cause	Affected Limb	Onset duration	CRPS type	VAS
Patient 1	43	F	Rt Knee meiscal allograft	Rt L/Ext	13mo.	II	7
Patient 2	39	F	Lt Knee medial meniscus op	Lt L/Ext	32mo.	II	5
Patient 3	39	M	Rt Fibula fx	Rt L/Ext	19mo.	II	7
Patient 4	34	M	Lt Humerus fx	Rt U/Ext	23mo.	II	8
Patient 5	64	F	Lt Shoulder arthroscopy	Rt U/Ext	160mo.	II	7

➢ Three-phase bone scan(TPBS)

- Tc-99m HDP 20mCi IV injection
- Perfusion , blood pooling, delayed phase(P-B-D)
- Obtained Symmetric/ decreased / increased (S,D,I) patterns in each phase

	Onset to exam days	TPBS P-B-D
Patient 1	7M	S-D-S
Patient 2	18M	I-I-S
Patient 3	2M	D-D-I
Patient 4	11M	S-S-S
Patient 5	96M	S-S-I

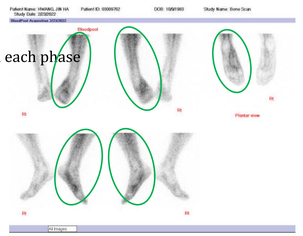

Figure : Patient 3, Decreased pattern in right lower extremity

➢ Digital Infrared Thermographic Imaging(DITI)

- Significant value : Temperature difference of 1'c or more / exceeding the reference

	Onset to exam days	DITI
Patient 1	14M	↓
Patient 2	29M	N/S
Patient 3	2M	↓
Patient 4	5M	N/S
Patient 5	144M	N/S

↓; significantly low temperature , N/S; Non significant result

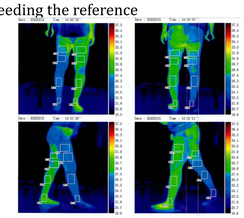

Figure : Patient 3, significantly low temperatures

➢ Angiography

- Requested Radiologist for angiography
- US guided access : Common femoral artery (ankle) , Radial artery (shoulder)
- Evaluate vascular abnormal staining and delayed perfusion

	Angiographic results
Patient 1	Poor perfusion
Patient 2	Poor perfusion
Patient 3	Poor perfusion / AV shunts
Patient 4	Increased staining
Patient 5	Increased staining

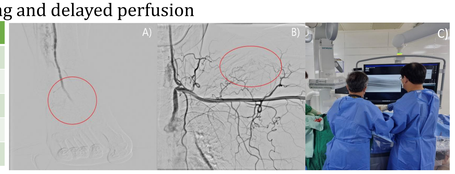

Figure : A) Poor vascular perfusion in arteries around ankle. B) Increased staining around left shoulder joint. C) Angiographic intervention room

Results

➢ Comparison of DITI, TPBS, and Angiographic results

- No similar pattern

	Angiographic results	TPBS P-B-D	DITI
Patient 1	Poor perfusion (9mo.)	S-D-S (14mo.)	↓ (14mo.)
Patient 2	Poor perfusion (29mo.)	I-I-S (29mo.)	N/S (29mo.)
Patient 3	Poor perfusion & AV shunts (13mo.)	D-D-I (2mo.)	↓ (2mo.)
Patient 4	Increased staining (17mo.)	S-S-S (5mo.)	N/S (5mo.)
Patient 5	Increased staining (159mo.)	S-S-I (144mo.)	N/S (144mo.)

TPBS;3-Phase Bone Scan, DITI; Digital Infrared Thermographic Imaging

- Possible tendency :
  - ✓ Patients with poor perfusion show decreased uptake and low temperature
  - ✓ Patients with increased staining show increased uptake
- However, small sample size

➢ Angiographic intervention

- Embolization for increased staining : Embolic agent (Imipenem/Cilastatin)
- Reperfusion for poor perfusion : Reperfusing agent (Eglandin)

	Angiographic results	Treatment	VAS Before / After intervention
Patient 1	Poor perfusion	Reperfusion	7 / 7
Patient 2	Poor perfusion	Reperfusion	5 / 5
Patient 3	Poor perfusion & AV shunts	Embolization	7 / 7
Patient 4	Increased staining	Embolization	8 / 8
Patient 5	Increased staining	Embolization	7 / 7

Conclusion

- The results of TPBS, DITI, and angiography - no similar pattern
- Embolization or reperfusion therapy - no significant effect on pain relief
- To overcome the limitations, controlled randomized controlled trial is necessary