

Vascular diseases or Neurogenic diseases ?

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Contents



Two cases of combined neuropathy and vasculopathy

Neuropathy around the foot

Vascular disease around the foot

Take home message

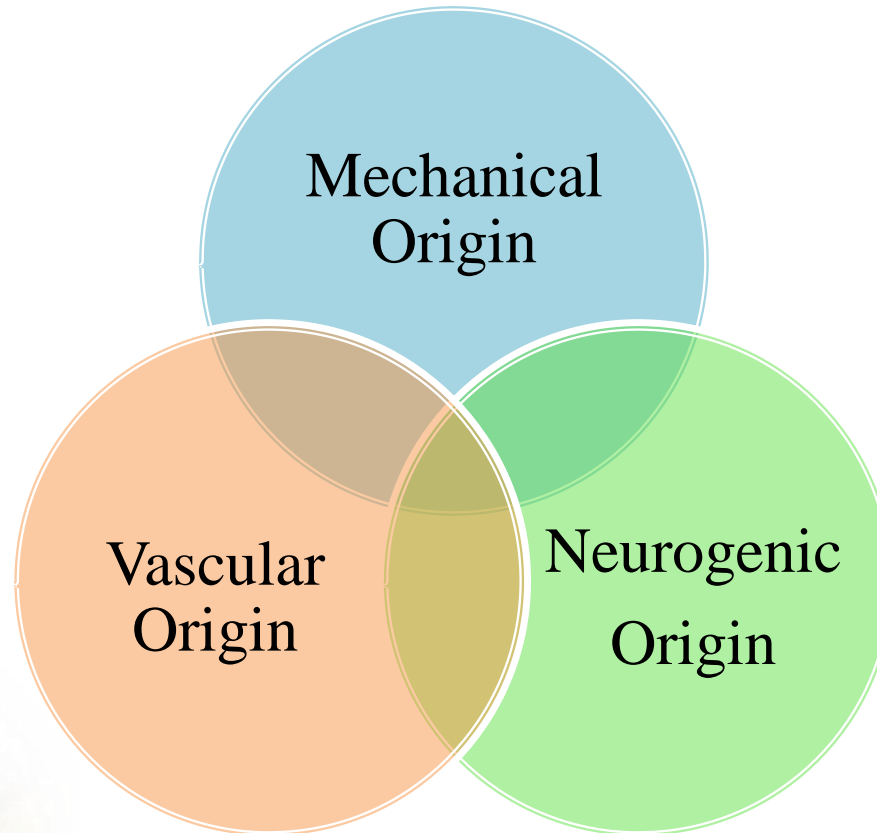




- 발이 시리다.
- 발이 저리다.
- 혈액순환이 좋지 않은 것 같다.
- 다리까지 쭉 타면서 저리다.
- 일어서서 처음은 증상이 없지만 좀 지나면 시린 게 나빠진다.
- 50m 이상 걸으면 다리가 아파 걷지를 못한다.
- 발가락 사이가 쿵쿵 쑤시면서 아프다.



Foot problems in the old patients



The Etiology of Foot Problems

	Vascular	Mechanical	Neurogenic
Remote or Systemic lesions	Asttherosclerosis Buerger's Disease Autoimmune Vasculitis Primary Raynaud's phenomenon		DM neuropathy Alcoholic neuropathy. Uremic neuropathy Spinal stenosis Lumbar Radiculopathy
Focal lesions	AV malformation	Bony spur, Ganglion cyst....	Tarsal tunnel syndrome. Anterior tarsal tunnel syndrome Sural nerve injury. Morton's neuroma



C/C: both lower extremity tingling sensation and coldness

Dx - Rt. Hemiplegia due to Lt. thalamic infarction

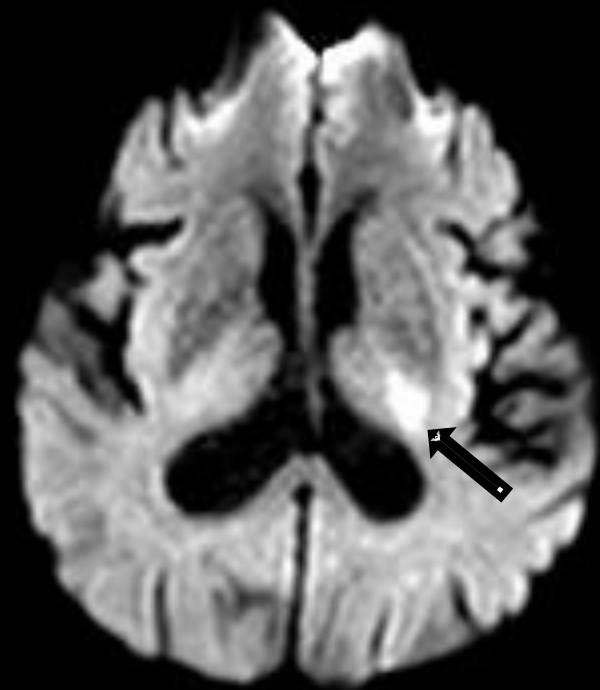
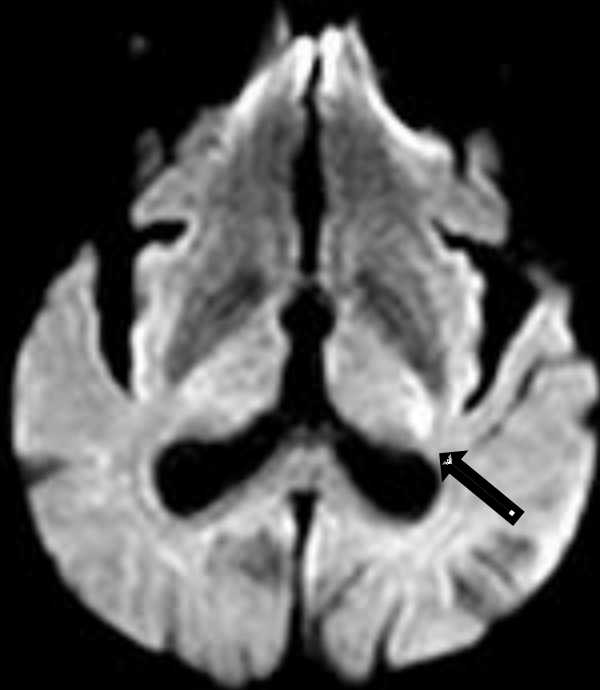
PhxHTN/DM/Pul.Tbc/hepatitis (-/+;7년/-/-) , - insulin 으로 혈당 조절 중

Lumbar spondylolisthesis and spinal stenosis (2012.7)

PI

- 2012.7월경 양측 hip에서 knee아래까지 tingling sense aggravation되어 힘찬병원 내원함. L-spine MRI상 HLD with spinal stenosis 있어 수술필요하나 여름이므로 우선 Injection을 권유 받음
- 2012.10.3 07:30am 화장실에 가려고 일어서는데 우측 다리에 힘이 없어 잘 걷지 못하였다고 하며, 화장실에서 바지를 올리려는데 우측 다리와 팔에 힘이 없어 올릴 수가 없었다고 함. 상기 증상으로 본원 ER 경유 신경과 adm.
- 2012.10.4 Brain MRI 상 Lt. thalamic infarction 소견 관찰되었고 MRA 상 ICAs 및 VAs에 atherosclerosis 소견 관찰됨. aspirin + plavix dual antiplatelet 투약 시작
- 2012.10.5 spine MR상 lumbar spondylolisthesis and spinal stenosis 관찰되어 수술치료 고려하였으나 당뇨 및 항혈소판제제 복용 중으로 수술적 risk 높아 보존적 치료하기로 함.
- 2012.10.10 CT lower extremity 상 PAOD 소견 관찰되었으나 both below knee 병변으로 PTA 등 intervention 적응증 되지 않았음. Cilostazol(Pletaal) 100mg#1 시작함.

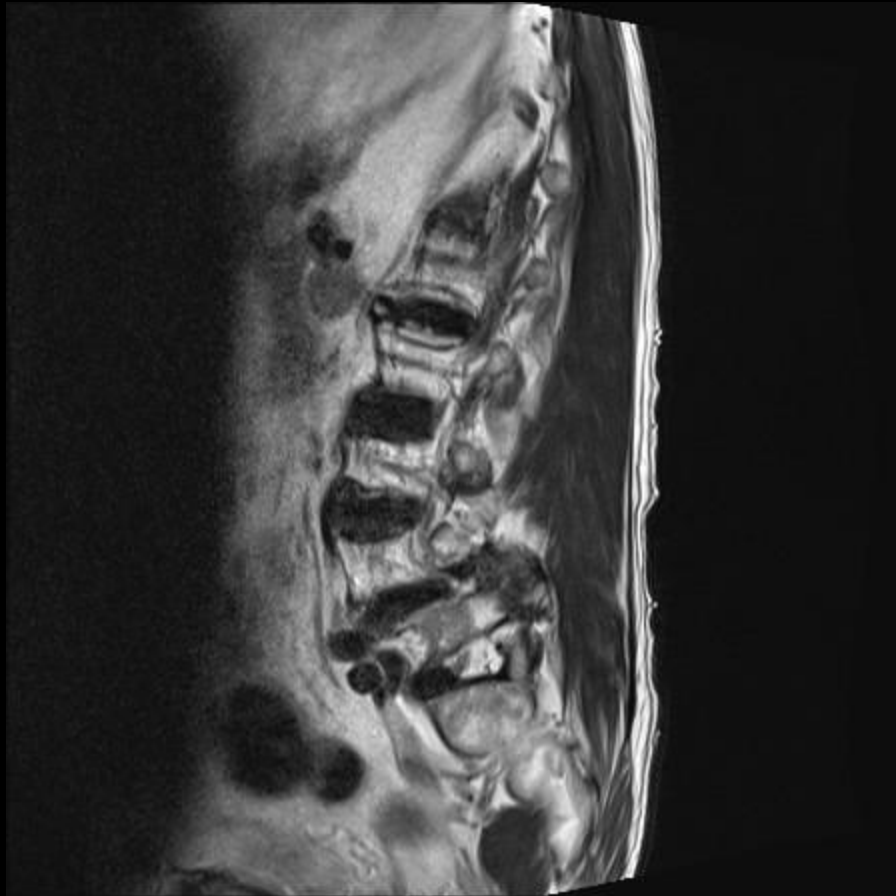
CASE 1



Case



L – Spine MRI



CT Angiography



EMG findings

Site	Onset (ms)	P-T Amp (μV)	Dist (cm)	Vel (m/s)
Left 3.Median Sensory (Rec)				
Wrist	2.3	20.8		
Elbow	2.6	21.3		
Left 4.Ulnar Sensory (Rec)				
Wrist	2.4	20.0		
B Elbow	2.5	20.1		
Left 7.Sup Peron Sensory (Ant Lat Mall)				
14 cm	2.3	7.8		
Site 2	2.6	8.5		
Right 7.Sup Peron Sensory (Ant Lat Mall)				
14 cm	1.6	5.0		
Site 2	1.8	5.6		
Left 8.Sural Sensory (Lat Mall)				
Calf	2.6	12.2		
Site 2	2.5	10.9		
Right 8.Sural Sensory (Lat Mall)				
Calf	2.1	10.9		
Site 2	2.4	10.5		

Muscle	I.A.	Fib.	P.S. W	Fasc .	Myoton ic Discharge	M.U.	P.P.	L.M. U.	R.P
Rt.L1-2						NMU			
Rt.L2-3						NMU			
Rt.L3-4						NMU			
Rt.L4-5						NMU			
Rt.L5-S1						NMU			
Lt.L1-2	+	+	+			NMU			
Lt.L2-3	+	+	+			NMU			
Lt.L3-4	+	+	+			NMU			
Lt.L4-5	+	+	+			NMU			
Lt.L5-S1	+	+	+			NMU			
Rt.TFL						NMU			C
Rt.VM						NMU			C
Rt.GCM						NMU			C
Rt.TA						NMU			P-C
Rt.EHL						NMU			P
Lt.TFL						NMU			C
Lt.VM						NMU			C
Lt.GCM						NMU			C
Lt.TA						NMU			C
Lt.EHL						NMU			C



1. Thalamic infarction
2. Lumbar Radiculopathy
3. Spinal Stenosis
4. DM neuropathy
5. Peripheral Arterial Obstruction Disease





HTN (20년, PO medi)

ESRD (고혈압성 신병증, HD 13년 CAOD (+,2년전 Stent)

s/p Endoscopic gastric ulcer coagulation (2012.8)

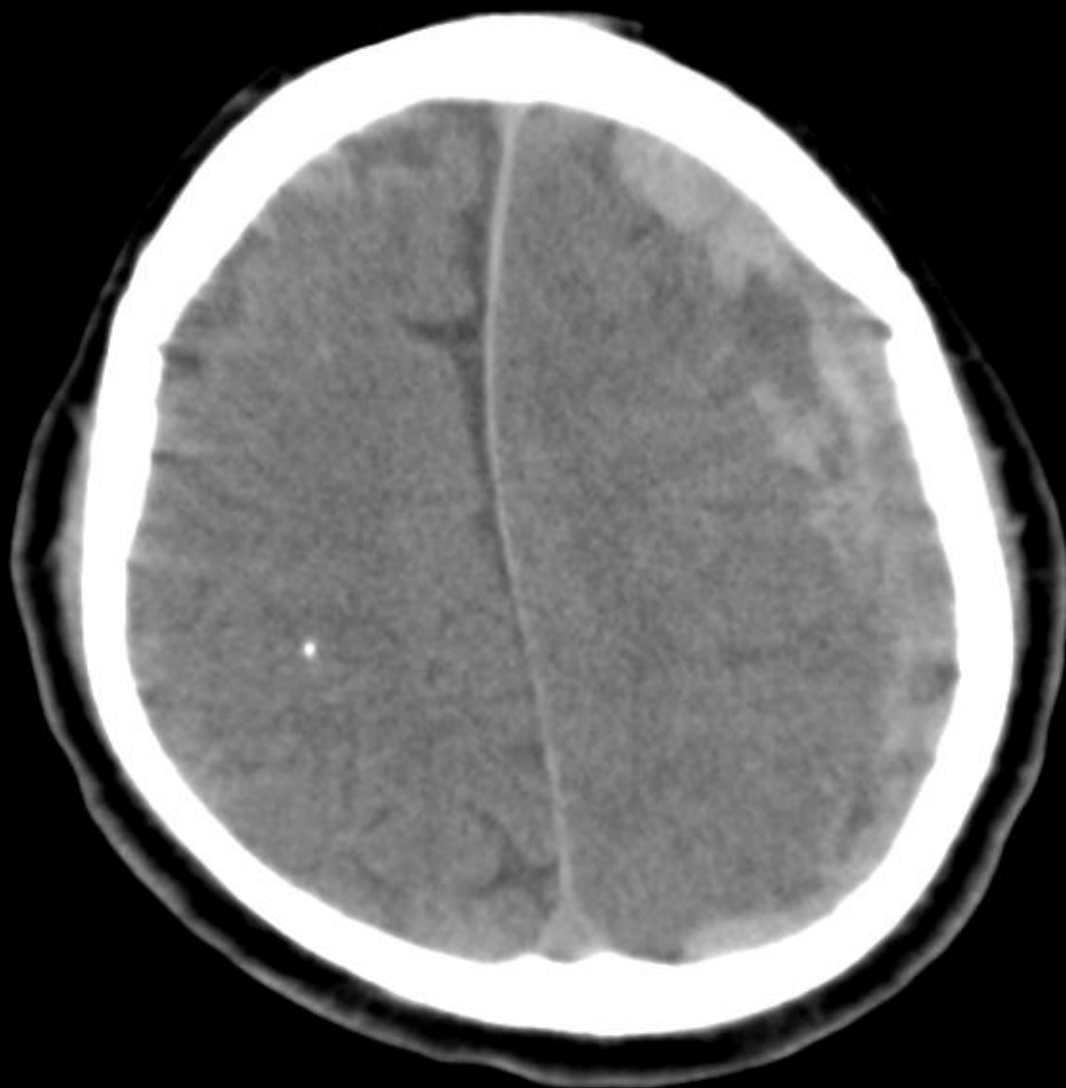
Smoking Hx (-) / Drinking Hx (-)

PI) 상기 환자

12.7.8 오전 3시경 갑작스런 두통으로 잠에서 깨어났다고 하며 3시20분 경 반복적으로 구토(총 5회)를 시작하고 구급차에서 mental stuporous 해짐. 신촌세브란스병원 ER에서 CT 상 Lt. F-T-P SDH 소견 확인하고 당일 Burr hole drainage of subdural hematoma 시행함.

- 12.7.26 f/u CT상 hematoma 남아있어 Burr hole drainage 재수술함.
- 12.7.27 GW로 이동함.
- 12.8 Melena있어 위내시경 시행 상 gastric ulcer있어 coagulation 시행함.
- f/u CT상 Hematoma 점차 resolution 됨.
- 12.10.9. 포괄적 재활치료 위해 본원 PMR 1st adm.

Brain CT



Se:
Im:0 (F1/1)



ANT

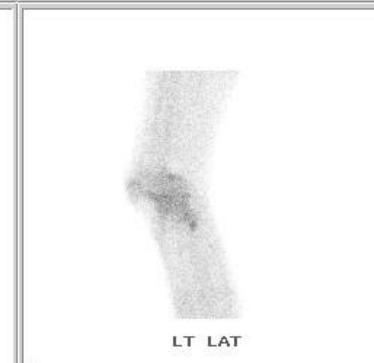
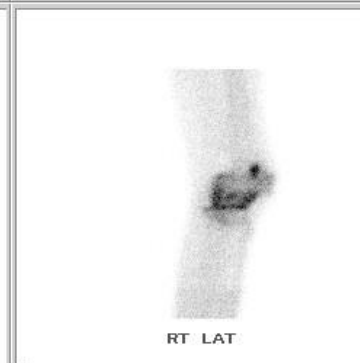
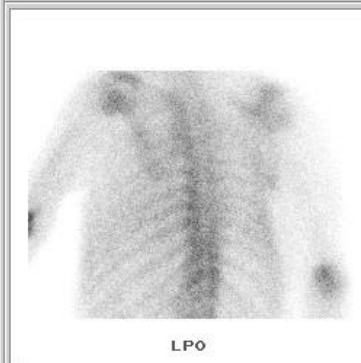
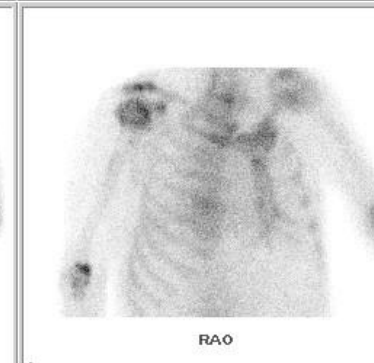
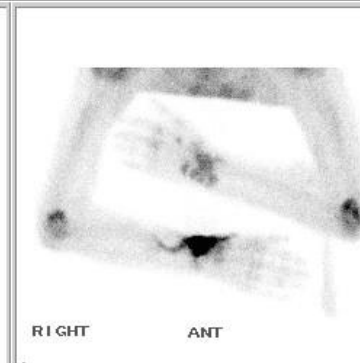
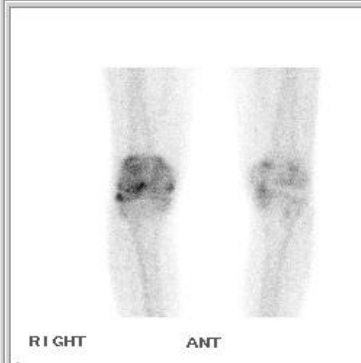
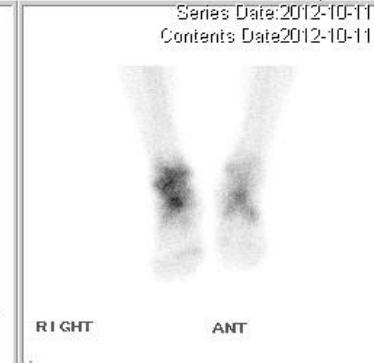
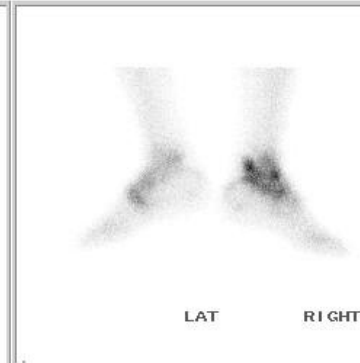
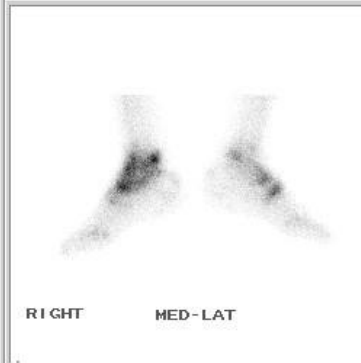


POST

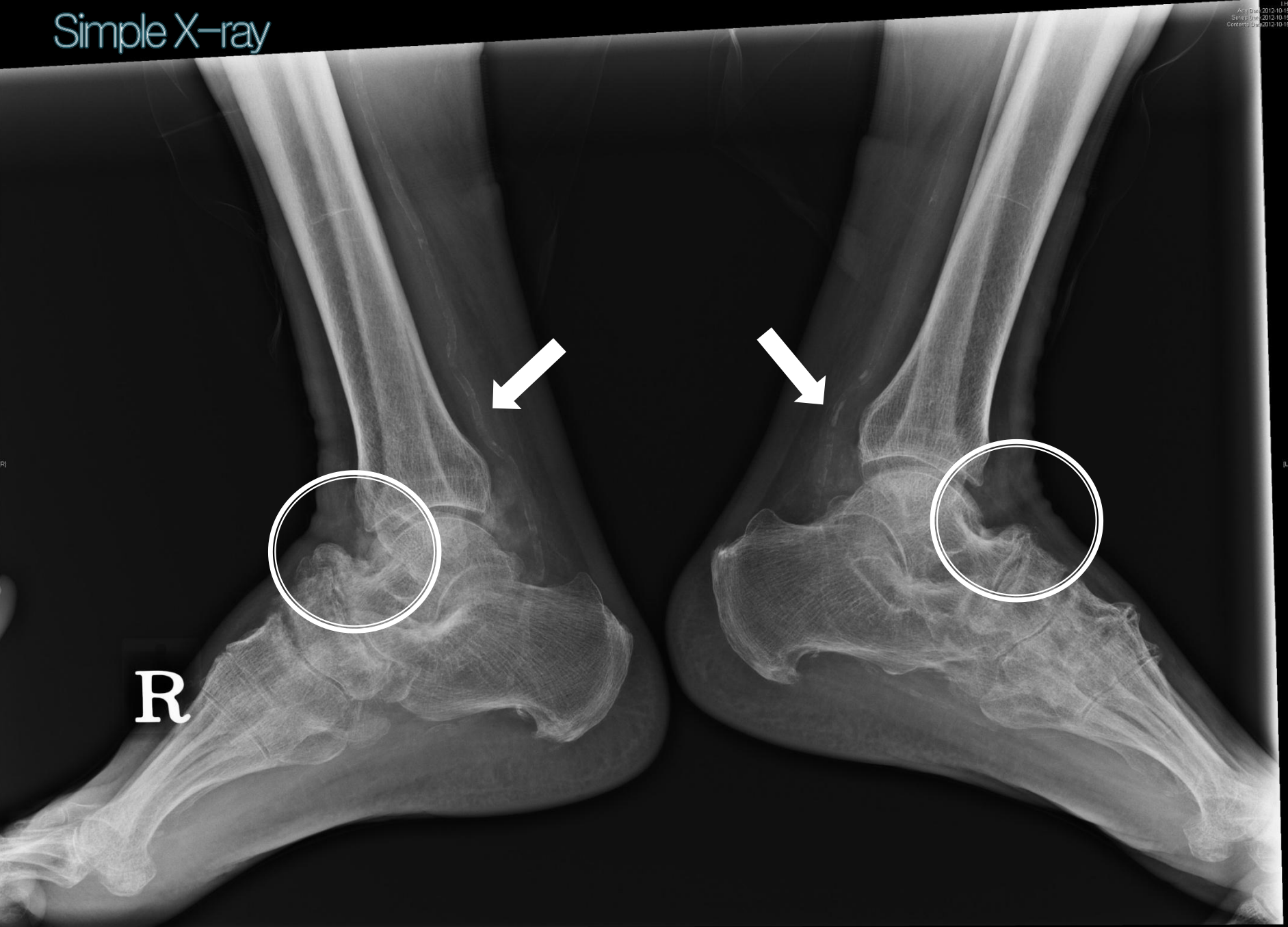
Bone Scan

Study Date:2012-10-11
Study Time:오후 12:27:45
MRN:

Acq Date:
Series Date:2012-10-11
Contents Date:2012-10-11



Simple X-ray



Study Date: 2012-10-15
Study Time: 5:25:23
MRN: 111
Acq Date: 2012-10-15
Series: 101
Current Date: 2012-10-15

EMG findings

Site	Onset (ms)	P-T Amp (mV)	Dist (cm)	Vel (m/s)
Left 1.Median Motor (Abd Poll Brev)				
Wrist	7.7	2.4	0.0	
Elbow	NT			
Right 1.Median Motor (Abd Poll Brev)				
Wrist	3.8	8.6	25.0	53
Elbow	8.5	8.0		
Left 2.Ulnar Motor (Abd Dig Minimi)				
Wrist	3.4	2.1	28.0	52
B Elbow	8.8	1.9		
Right 2.Ulnar Motor (Abd Dig Minimi)				
Wrist	3.6	6.9	28.0	52
B Elbow	9.0	6.0		
Left 5.Peroneal Motor (Ext Dig Brev)				
Ankle	4.1	0.5	33.0	46
B Fib	11.2	0.3		
Right 5.Peroneal Motor (Ext Dig Brev)				
Ankle	4.4	0.6	33.0	40
B Fib	12.7	0.4		
Left 6.Tibial Motor (Abd Hall Brev)				
Ankle	5.2	0.9	36.0	41
Knee	17.2	0.6		
Right 6.Tibial Motor (Abd Hall Brev)				
Ankle	5.7	1.8	36.0	40
Knee	14.7	1.5		

Site	Onset (ms)	P-T Amp (μV)	Dist (cm)	Vel (m/s)
Left 3.Median Sensory (Rec)				
	NR		0.0	
			0.0	
Right 3.Median Sensory (Rec)				
Wrist	2.8	21.6	0.0	
Elbow	2.7	22.9	0.0	
Left 4.Ulnar Sensory (Rec)				
Wrist	2.7	9.5	0.0	
B Elbow	2.7	7.2	0.0	
Right 4.Ulnar Sensory (Rec)				
Wrist	2.8	19.5	0.0	
B Elbow	2.9	20.1	0.0	
Left DorUlnar Sensory (Rec)				
Wrist	1.5	3.2	0.0	
B Elbow	1.7	4.2	0.0	
Left Median Acr Palm Sensory (2nd Digit)				
Wrist	NR		0.0	
Left 7.Sup Peron Sensory (Ant Lat Mall)				
14 cm	2.3	6.3	0.0	
Site 2	2.1	5.4		
Right 7.Sup Peron Sensory (Ant Lat Mall)				
14 cm	2.1	5.7	0.0	
Site 2	2.1	6.9		
Left 8.Sural Sensory (Lat Mall)				
Calf	2.4	6.7	14.0	44
Site 2	2.3	5.5		
Right 8.Sural Sensory (Lat Mall)				
Calf	2.7	6.2	0.0	
Site 2	2.6	7.7		

Se:504
Im:72

MEDCOM RESAMPLED - 손실 압축
[H]

RES/CQ/CROP/MP
Study Date: 2012-10-23
Study Date: 2012-10-23
Study Time: 오전 11:15:51
CRAN/CAUD
MRN:
N.I.
Acq Date: 2012-10-23
Series Date: 2012-10-23
Contents Date: 2012-10-23

[RA]

[LB]



[F]

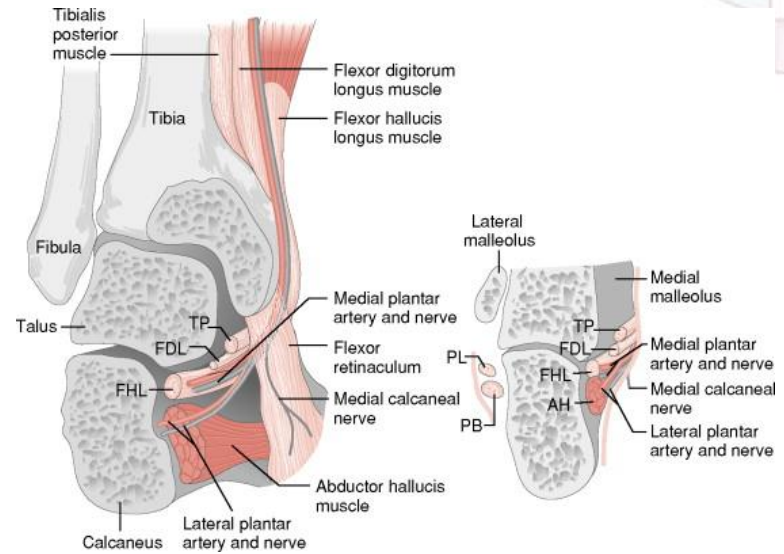
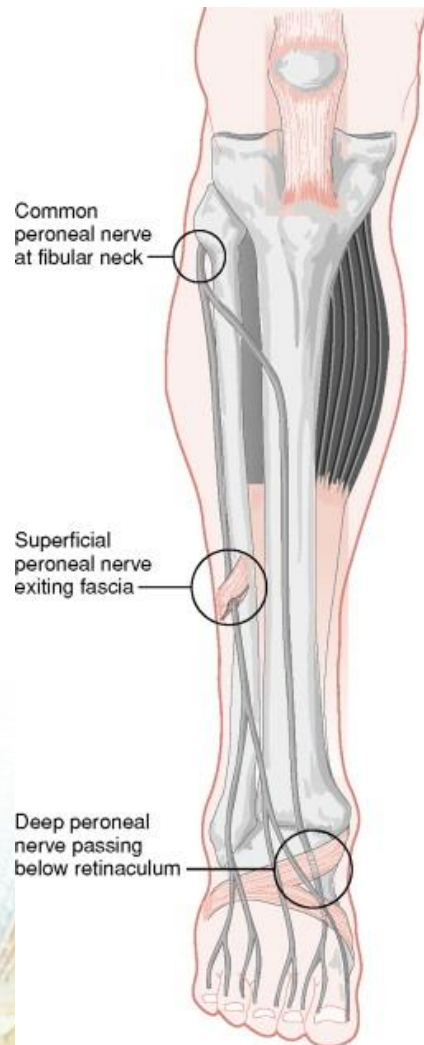
C270
W516

Impression

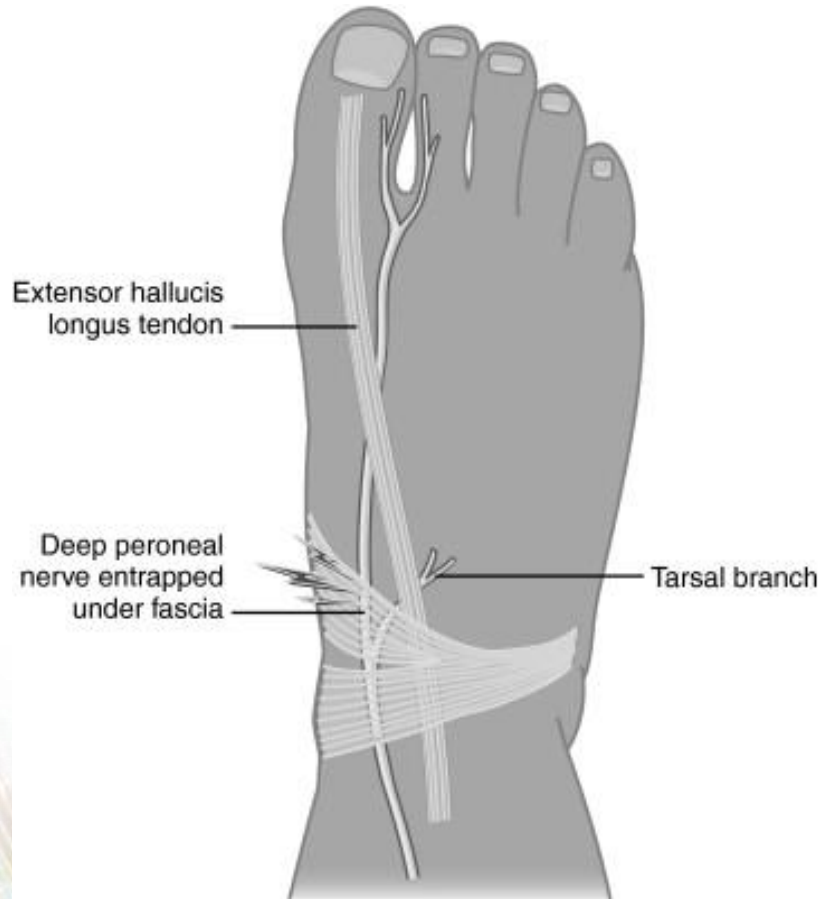
1. PAOD
2. Uremic polyneuropathy
3. Ankle OA
4. 2ndary hyperparathyroidism

검사명		결과	Sign	하한	상한
TIBC	TIBC	195	▼	244	393
Fe(iron)	%Sat,Fe	65.6			
Electro profile(Na,K,Cl)	Na	138		135	145
	K	3.9		3.5	5.5
	Cl	102		98	110
T-CO2	T-CO2	23.7		22	32
Ferritin	Ferritin	577.6	▲	21.8	274.7
Parathyroid hormone	Parathyroid hormone	388.40	▲	15	65
HBs Ag(CLIA)	HBs Ag(CLIA)	active(0.15/		Negative	Negative
Anti-HBs(CLIA)	Anti-HBs(CLIA)	sitive(13.4			
Routine CBC with diff.					
	WBC	6.0		3.7	10.0
	RBC	2.79	▼	4.5	6.3
	Hb	8.5	▼	14.0	17.0
	Hct	25.7	▼	39.0	51.0
	MCV	92.1		80	94
	MCH	30.5		26.0	32.0
	MCHC	33.1		32	36
	RDW	15.8	▲	11.3	15.5
	PDW	11.4		9.3	16.0
	MPV	10.7		9.4	12.6

Nerve Entrapment Syndromes of Foot



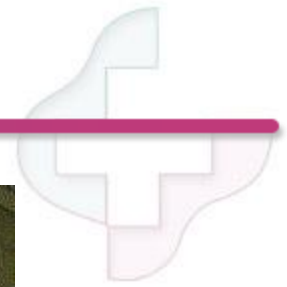
Symptoms of Anterior Tarsal Tunnel Syndrome



Within Anterior tarsal tunnel

- 4 tendons, 1 artery (dorsalis pedis), 1 vein, and deep peroneal nerve
- 1 Cm above the ankle joint
 - Deep peroneal nerve divides into a medial and lateral nerve
 - Medial branch continues with the dorsalis pedis
 - Compressed over talonavicular joint
 - Dysthesia in the first web space
 - Lateral branch—sensory branches to the ankle joint and maintaining functional ankle stability

Causes of Anterior Tarsal Tunnel Syndrome



1. Repeattive mechanical irritation of the nerve at ankle
2. Space occupying lesions such as Ganglia
3. Postural causes: forefoot valgus, with plantar flexed first ray with mid tarsal joint inversion
4. Tight shoe
5. Bony exostosis
6. Iatrogenic



52/F Lt. 1st web space tingling sensation

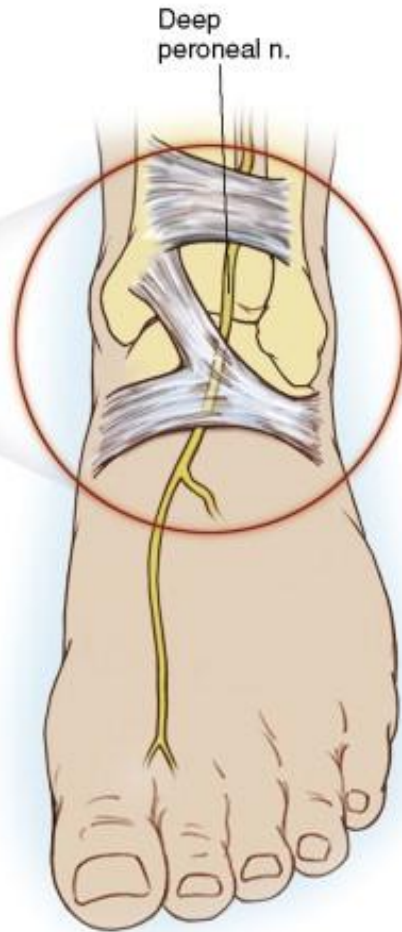
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MRN: 111111111
Acq Date: 2013-08-22
Series Date: 2013-08-22
Comments: Data01 1-08-22

[M]

C2048
W4036



Anterior Tarsal Tunnel Syndrome



Symptoms

- Numbness, Paresthesia, Hypoesthesia in the first web space
- Worsen with Activity
- Weakness or atrophy of EDB muscle
- Tinnel's sign

DDX

- Lumbar Radiculopathy
- Morton's neuroma
- Ankle sprain
- Superficial peroneal entrapment

Treatment

- Medication and Physical therapy
- Shoe modification
- Sonoguided injection

Tarsal Tunnel Syndrome or Posterior Tarsal Tunnel Syndrome

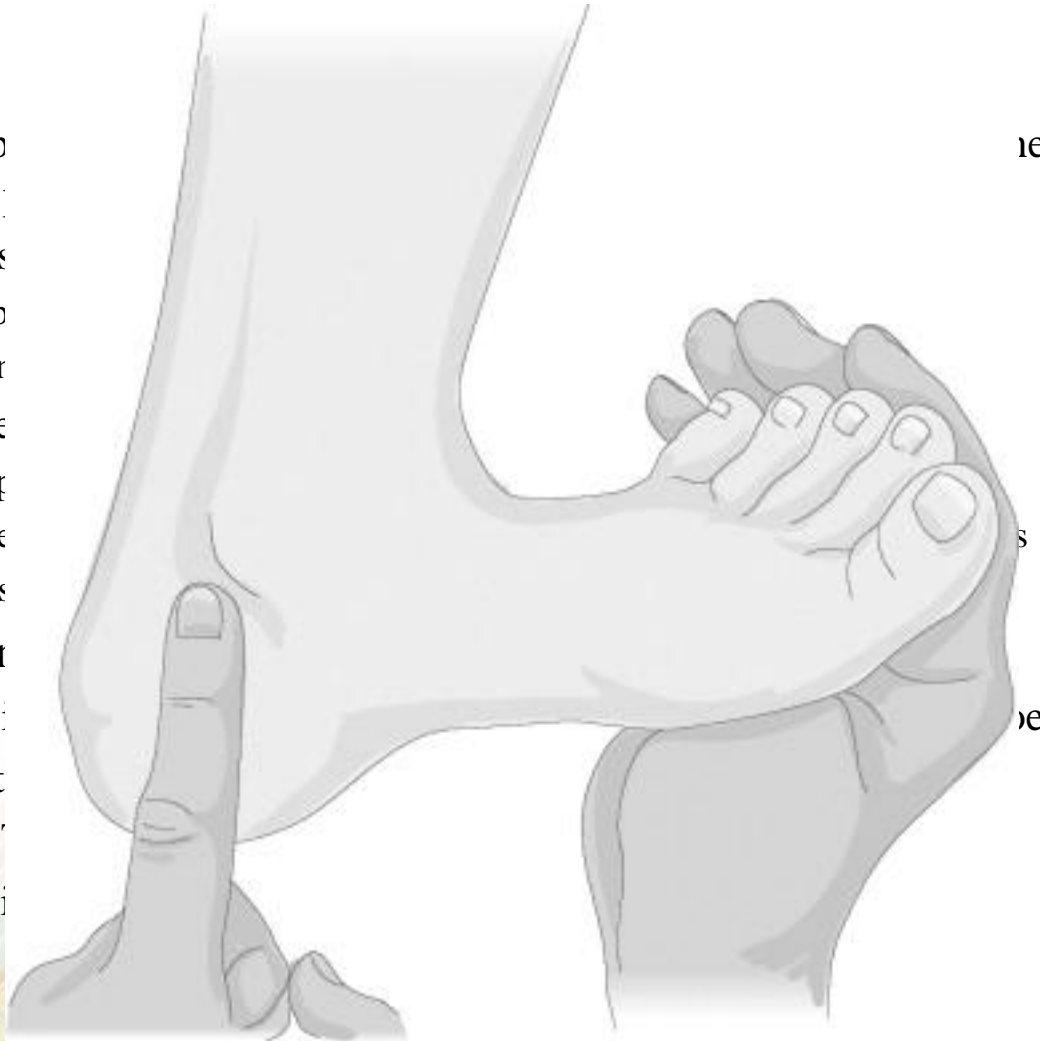


- Definition

- The symptoms are caused by the compression of the tibial nerve or its branches
- Much less common than Carpal Tunnel Syndrome
 - Symptoms
 - Diagnosis
- Most cases are caused by:
 - Compression of the nerve
 - Ankle injury
 - Excessive pronation

- Symptoms are:

- Paresthesia
- Worse after prolonged standing
- Positive Tinel's sign
- Dorsiflexion



ie tibial nerve or its

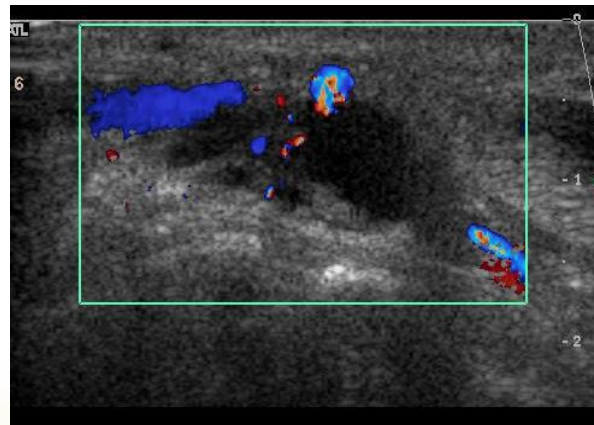
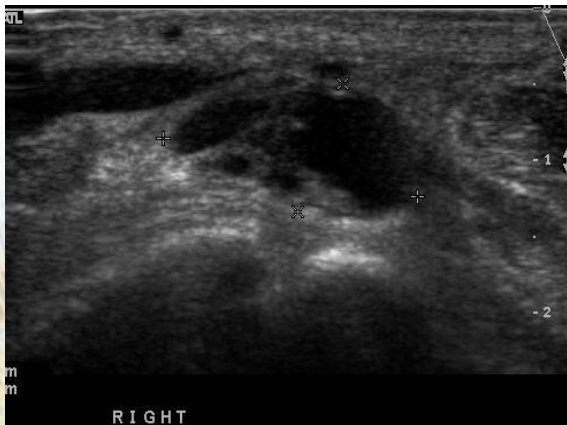
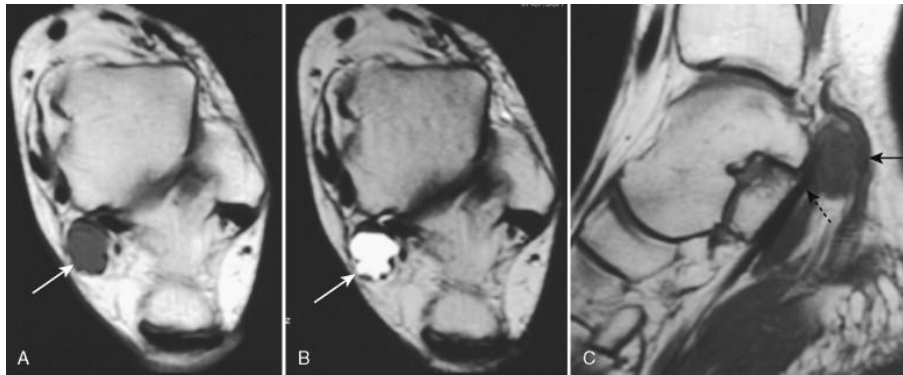


- Etiology
 - Fracture or dislocation of talus, calcaneus, medial malleolus
 - Tight shoes, casts
 - Ganglion, Cyst, tumor
 - Rheumatoid arthritis, Tenosynovitis
 - Excessive pronation in runners
 - Ankle sprain
 - Unknown cause-20%
- D/Dx
 - Complex regional pain syndrome (discoloration of foot, skin and temperature change)
 - Diabetic neuropathy (history of diabetes, bilateral loss of nerve function in a stocking distribution)
 - HLD
 - Other peripheral neuropathy
 - Tibialis posterior dysfunction

Diagnosis of Tarsal tunnel Syndrome



- Simple Radiographs of the foot and ankle –rule out bony pathology
- MRI and Ultrasonography

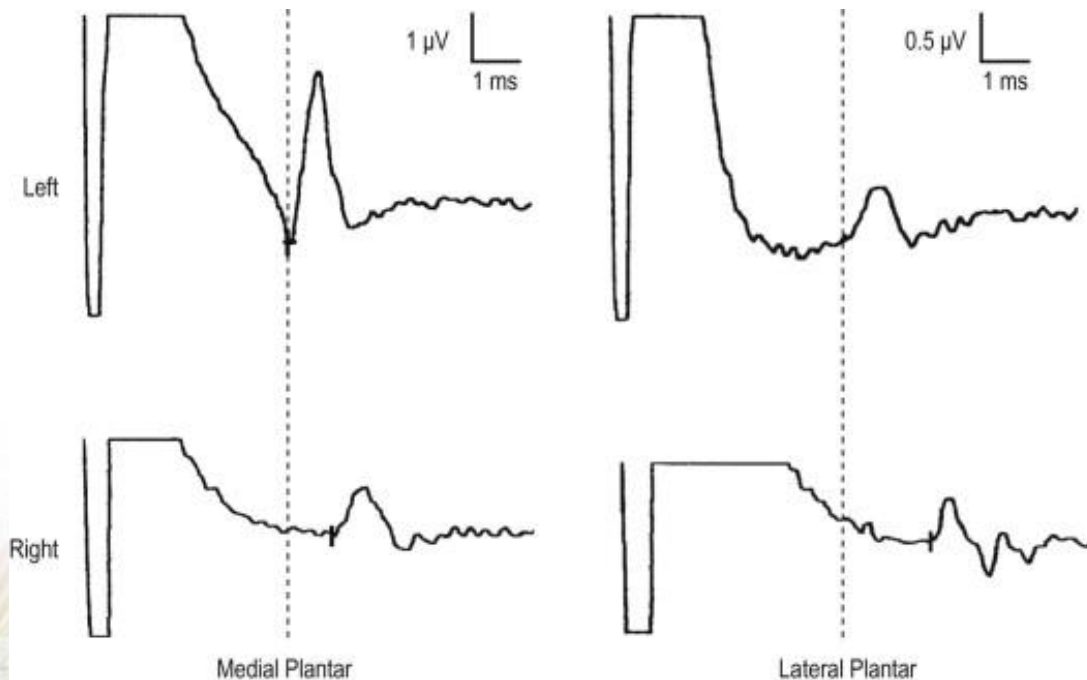


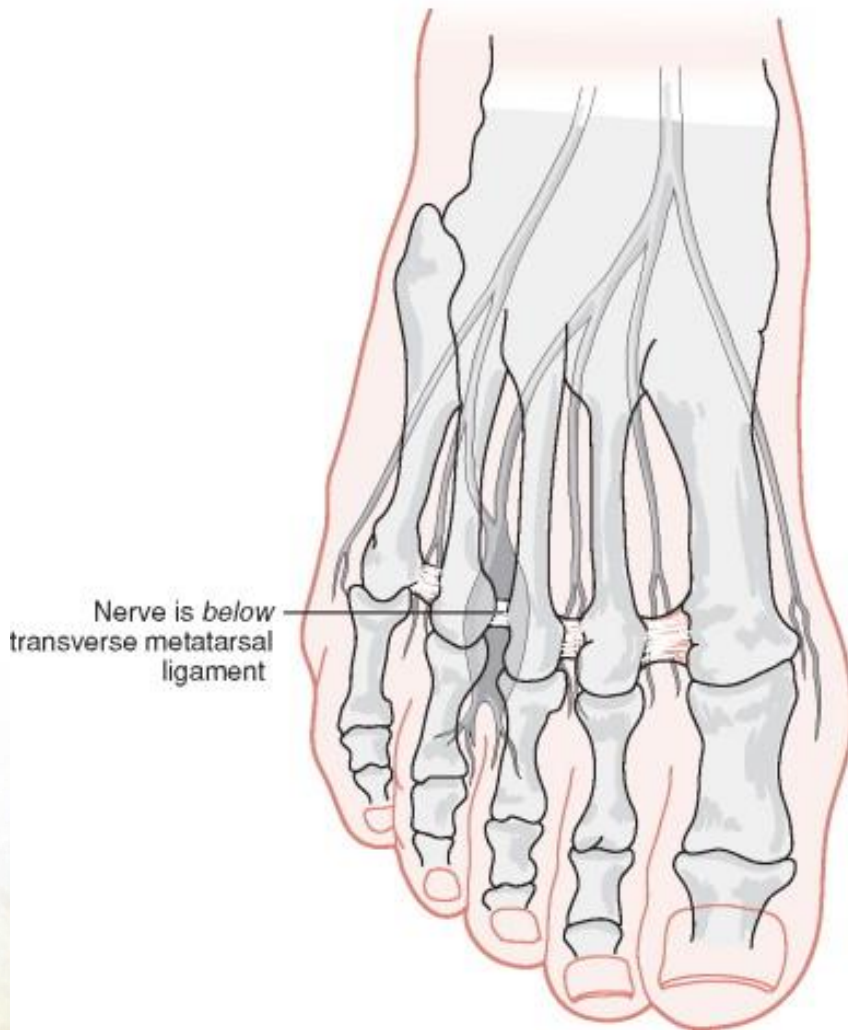
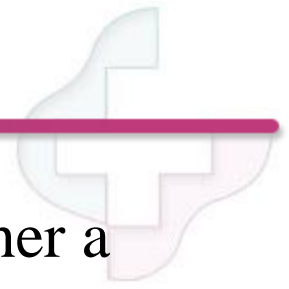
Diagnosis of Tarsal tunnel Syndrome



- EMG

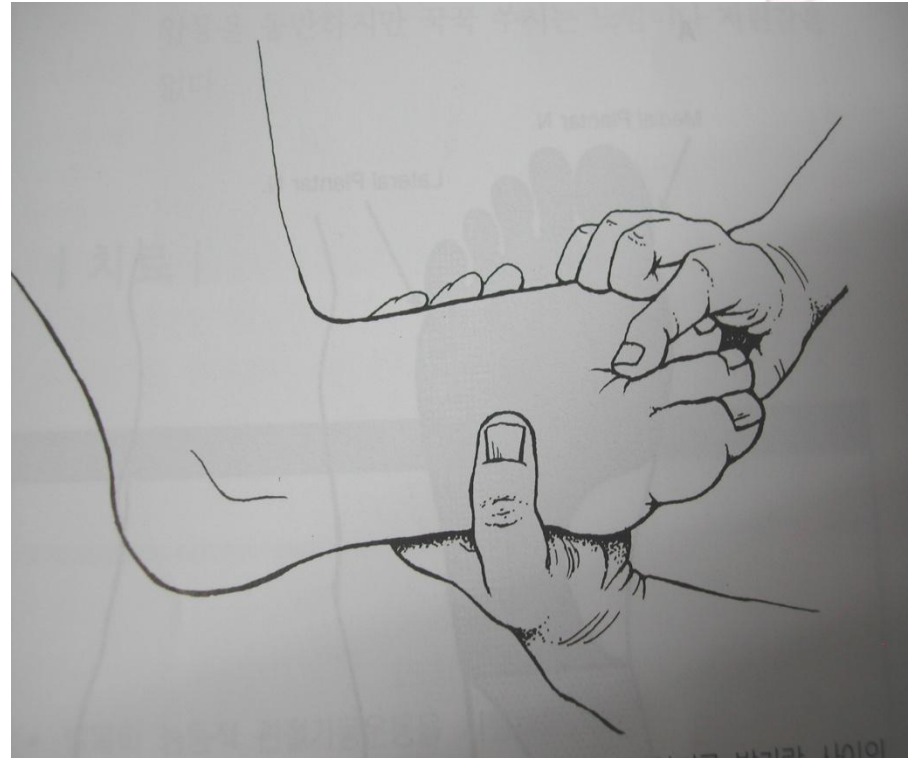
- may identify tibial nerve entrapment, but at the ankle level and below, the test is not as accurate as in the upper extremity
- A positive and negative test does not always correlate with intraoperative findings



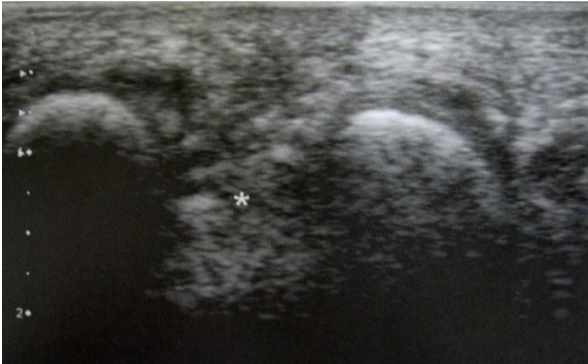


- Not true neuroma but rather a perineural fibrosis of the common digital nerve
 - Fibrosis is secondary to repetitive irritation of the nerve
 - 3rd web space(64%~91%) > 2nd web space(18%~32%) >> 1st, 4th web space
 - Female: Male=5:1
 - Probably related to compression of the nerve by tight toes.

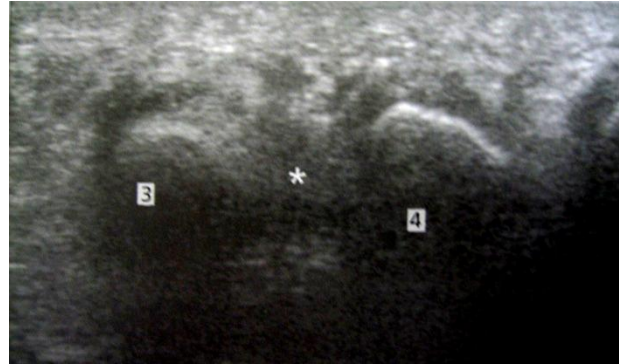
- Symptom and Sign
 - Buring pain
 - Tingling/Numbness
 - Wrinkled Sock sensation, Walking on Marble sensation
 - Symptoms are exacerbated and relived by foot wears.
 - Pain on palpation involved intermetatarsal space
 - Mulder's Sign
 - Squeezing the forefoot and applying plantar and dorsal pressure
 - Click or Pop can be felt or heard; painful



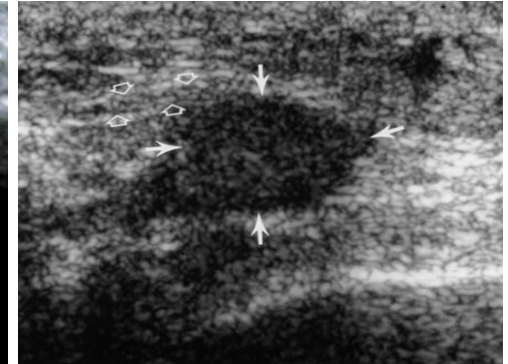
Diagnosis of Morton's Neuroma



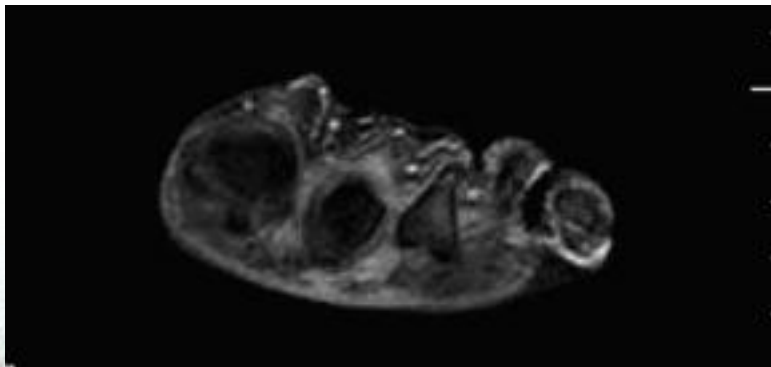
Normal



Abnormal –
Transverse view



Abnormal –
Longitudinal view



Coronal T1 fat-suppressed



- Medication
- Shoe modification and Shoe change or foot wear alteration
- Metatarsal pad
- Corticosteroid injection or Bezyl alcohol, phnol injection, thermocoagulation
- Surgical therapy
 - Decompression and Excision

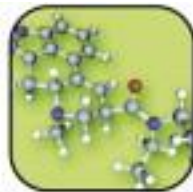


Pathophysiology of digital vasospasm



Decreased Intravascular Pressure

Low systemic blood pressure
Atherosclerosis
Thromboangiitis obliterans



Exogenous Administration of Vasoconstrictor Agents

Ergot alkaloids
Sympathomimetic drugs



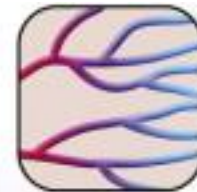
Endogenous Vasoconstrictive Stimuli

Digital vascular hyperactivity
Increased sympathetic nervous system activity
Circulating vasoactive hormones



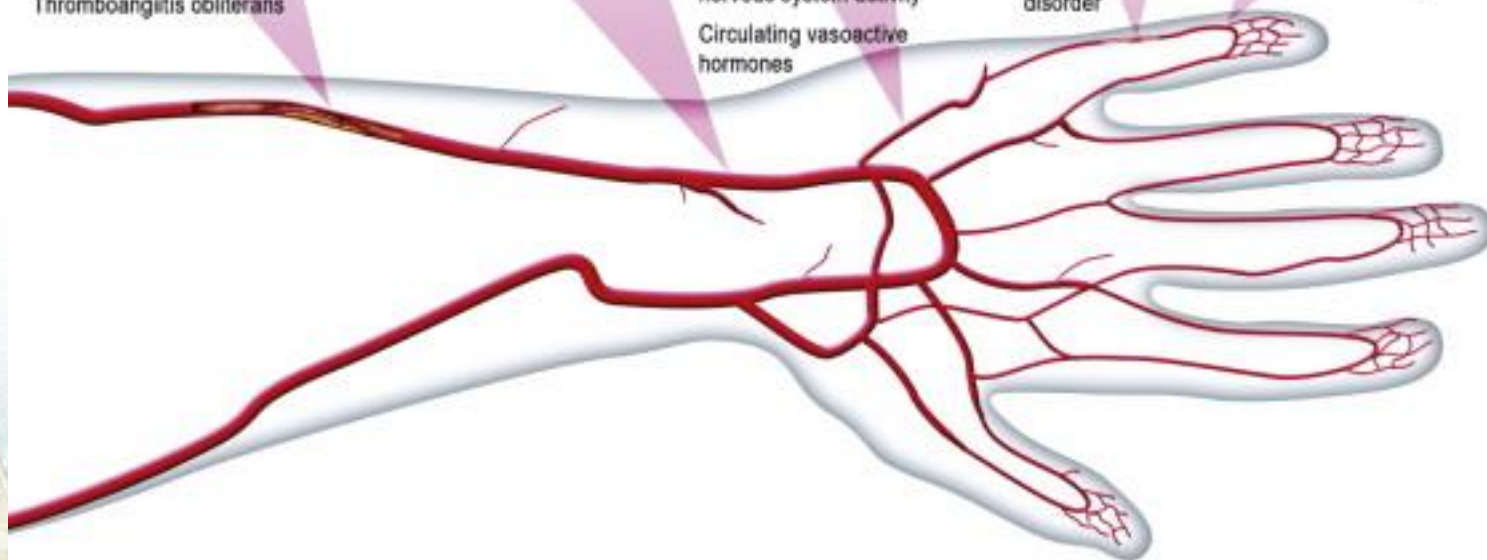
Digital Arterial Occlusions

Thrombus
Embolism
Connective tissue disorder



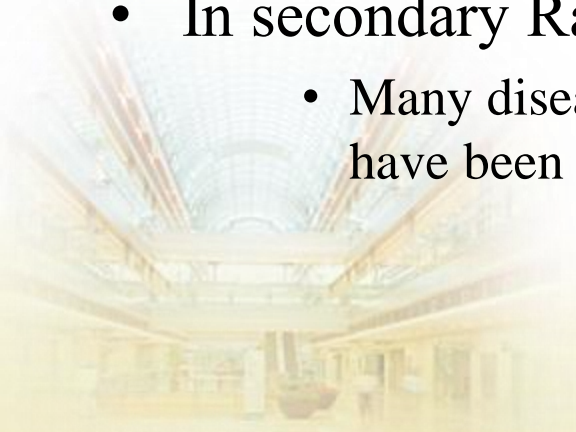
Hematologic Disorders

Hyperviscosity
Cryoglobulinemia
Cold agglutinins





- An exaggerated vascular response to cold temperature or emotional stress.
 - by sharply demarcated color changes of the skin of the digits.
- In primary Raynaud's phenomenon
 - evidence suggests the defect is an increase in alpha-2 adrenergic responses in the digital and cutaneous vessels
 - idiopathic
- In secondary Raynaud's phenomenon or Syndrome
 - Many diseases, disorders, drugs, and environmental exposures have been associated with secondary RP



Disorders and factors associated with Raynaud's phenomenon

Rheumatological diseases
Scleroderma
Systemic lupus erythematosus
Polymyositis/dermatomyositis
Sjögren's syndrome
Undifferentiated connective tissue disease
Mixed connective disease
Hematologic/oncologic
Paraneoplastic syndrome
Cryoglobulinemia
Cryofibrinogenemia
Cold agglutinin
Paraproteinemia
POEMS syndrome
Endocrine
Hypothyroidism
Vascular
Thoracic outlet syndrome
Emboli
Vasculitis
Prinzmetal angina
Atherosclerosis
Thromboangiitis obliterans
Neurological
Carpal tunnel syndrome
Migraine headache
Environmental
Vibration injury
Frost bite
Emotional stress
Drugs/toxins
Sympathomimetic drugs
Chemotherapeutic drugs
Interferons
Nicotine
Cocaine
Ergotamines
Polyvinyl chloride

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Non Pharmacologic Treatment of Raynaud's Phenomenon



- Avoidance of cold exposure, especially sudden changes such as walking into the frozen food section of a grocery store
- Use of strategies to keep the whole body warm, including dressing warmly (eg, with thermal underwear and heat conserving hat)
- Keeping digits of the hands and feet warm (eg, winter gloves, chemical hand warmers, and heavy wool stockings). Placing the hands under warm water or in a warm place (such as the axilla), or rotating arms in a whirling or windmill pattern. Rubbing the hands together can help.
- Avoidance of rapidly changing temperatures, such as quickly moving from a hot environment into an air-conditioned room ; sitting motionless in cool breezes, or humid cold air is also recommended.
- Avoidance of smoking is recommended
- Avoidance of sympathomimetic drugs and some of the medications used for migraine headaches
- Discontinuing caffeine-containing beverages has also been recommended
- All patients with RP should avoid repeated trauma to the fingertips, and patients with vibration-induced RP should avoid use of vibrating tools.
- Emotional stress should be controlled because the thermoregulatory vessels are constricted by increased sympathetic tone. Stress plus cold exposure is an especially potent trigger for RP



- Calcium channel blocker
 - useful in treating both primary and secondary RP
 - not all calcium channel blockers appear to be beneficial
 - Effective doses of nifedipine range from 30 to 180 mg/day and for amlodipine from 5 to 20 mg/day.
- Nitroglycerine 2% ointment
- Other vasodilator
 - Prazocin, sildenafil, angiotensin receptor blocker inhibitor
- Direct vasodilator
 - nitroglycerin, nitroprusside, hydralazine, papaverine, minoxidil, niacin and topical agents, including: nitric-oxide (via a generating system), hexyl nicotinate, ethyl nicotinate, and thurfyl salicylate
- Prostaglandins
 - potent vasodilators, inhibit platelet aggregation, have additional biological functions that may improve abnormal vascular reactivity
- Others
 - Statin, Aspirin, dipyridamole, LMWH

Invasive treatment of Raynaud's Phenomenon



- Chemical sympathectomy
 - Digital block with lidocaine or bupivacaine
 - Use of intradigital botulinum toxin
- Cervical and lumbar sympathectomy
- Localized digital sympathectomy
- Vascular reconstruction





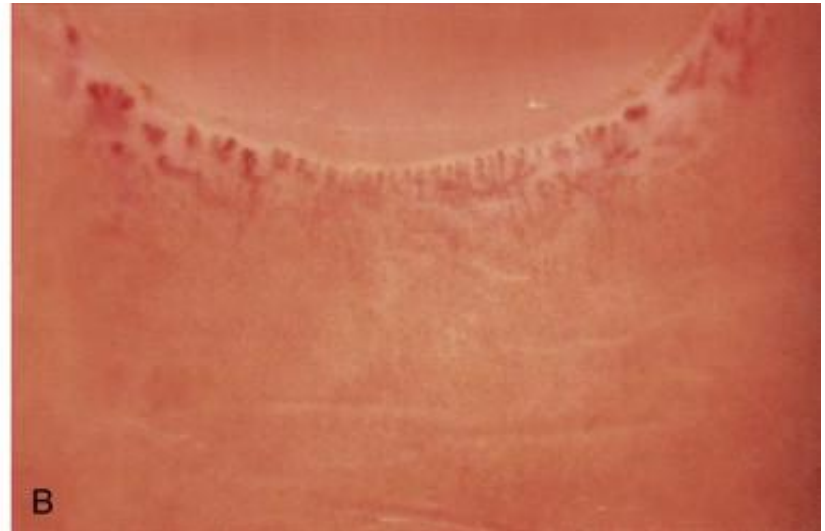
- The term scleroderma is used to describe the presence of thickened, hardened skin. Scleroderma is the hallmark feature of a heterogeneous group of conditions
 - CREST(Calcinosis, Raynaud’s Syndrome, Esophageal dysmobility, Sclerodactyly, Telangiectasia) syndrome.
 - Localized scleroderma
 - Systemic scleroderma

Subset of Systemic Sclerosis

	Diffuse	Limited
Skin involvement	Distal and proximal extremities, face, Trunk	Face, distal to elbow
Raynaud’s phenomenon	Onset within 1 year or at time of skin change	May precede skin disease by years
Organ involvement	Pulmonary, renal, gastrointestinal, cardiac	Gastrointestinal, pulmonary artery hypertension
Nail fold capillaries	Dilatation and dropout	Dilatation without significant dropout
Antinuclear antibodies	Antitopoisomerase I	Anticentromere



Normal



Abnormal

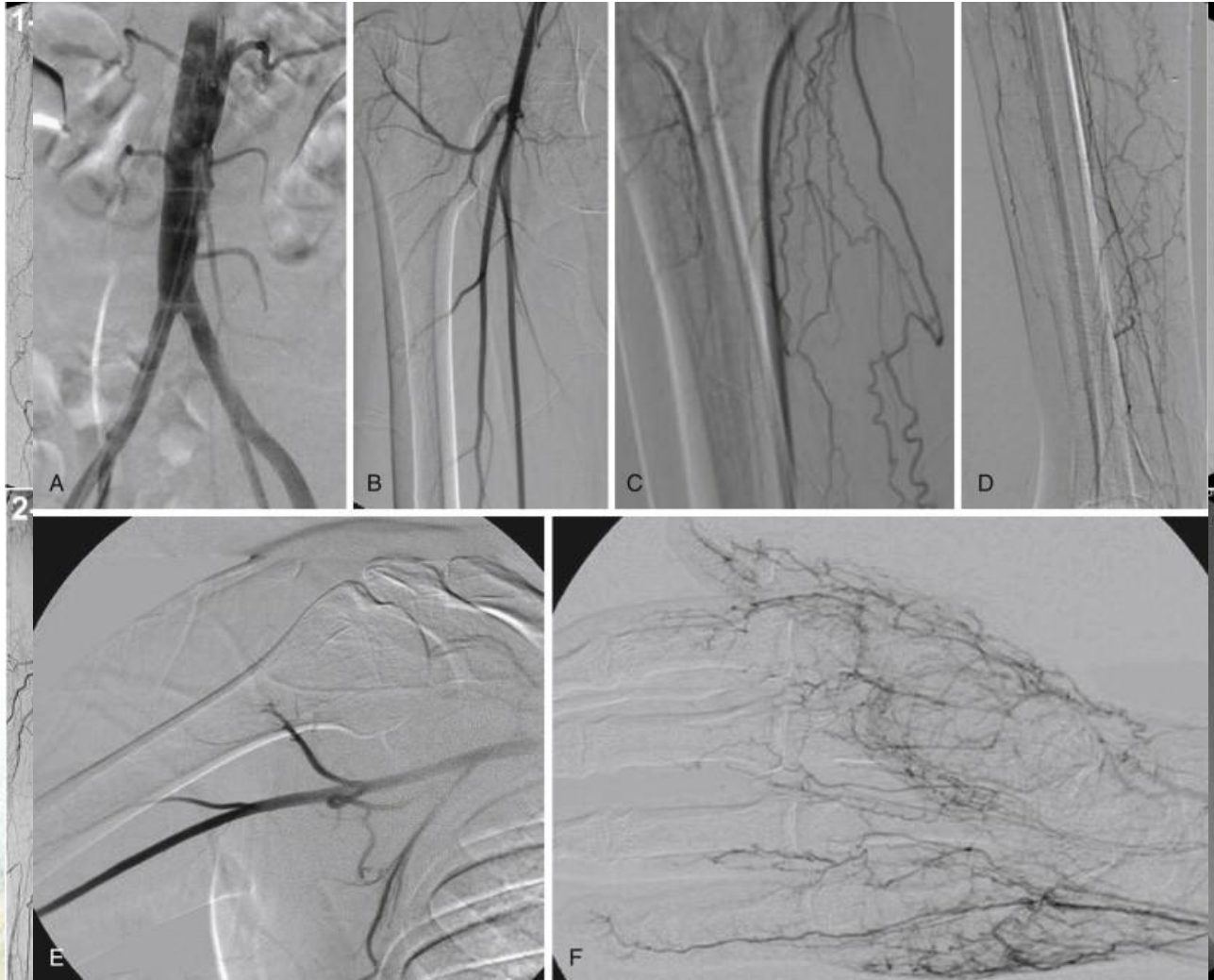
Thromboangiitis obliterans(Buerger's disease)



- a nonatherosclerotic, segmental, inflammatory disease
 - begins with the distal arteries and veins, followed by more proximal arterial occlusive disease
 - Digit (toe, finger) ischemia is the most common presentation
- affects the small to medium-sized arteries and veins of the extremities
- highly cellular and inflammatory occlusive thrombus with relative sparing of the blood vessel wall
- Patients are young smokers (40~45 years)
 - The use of tobacco is essential for the initiation and progression
 - distal extremity ischemia, ischemic digit ulcers or digit gangrene
- Diagnosis
 - ESR, CRP
 - ANA, RF, Complement, Anticentromere antibody, SCL 70
 - coagulation tests, antiphospholipid antibodies, anticardiolipin antibodies, protein C, protein S, antithrombin III, factor V Leiden and prothrombin gene mutation

Thromboangiitis obliterans (Buerger's disease)

Imaging test



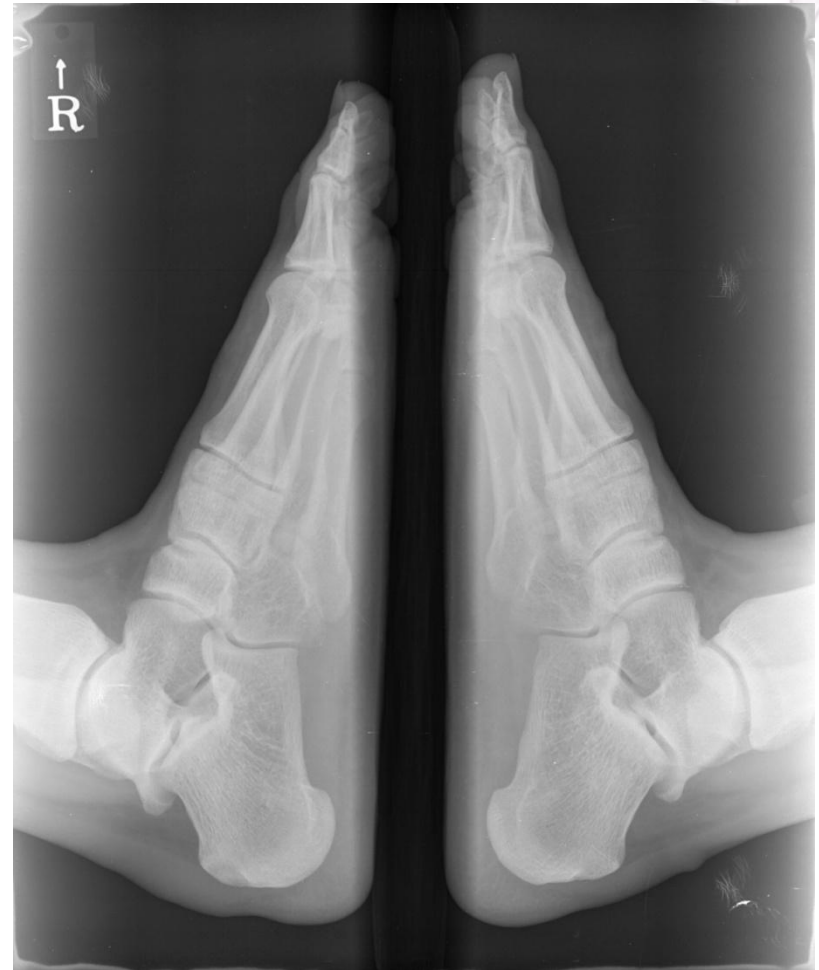
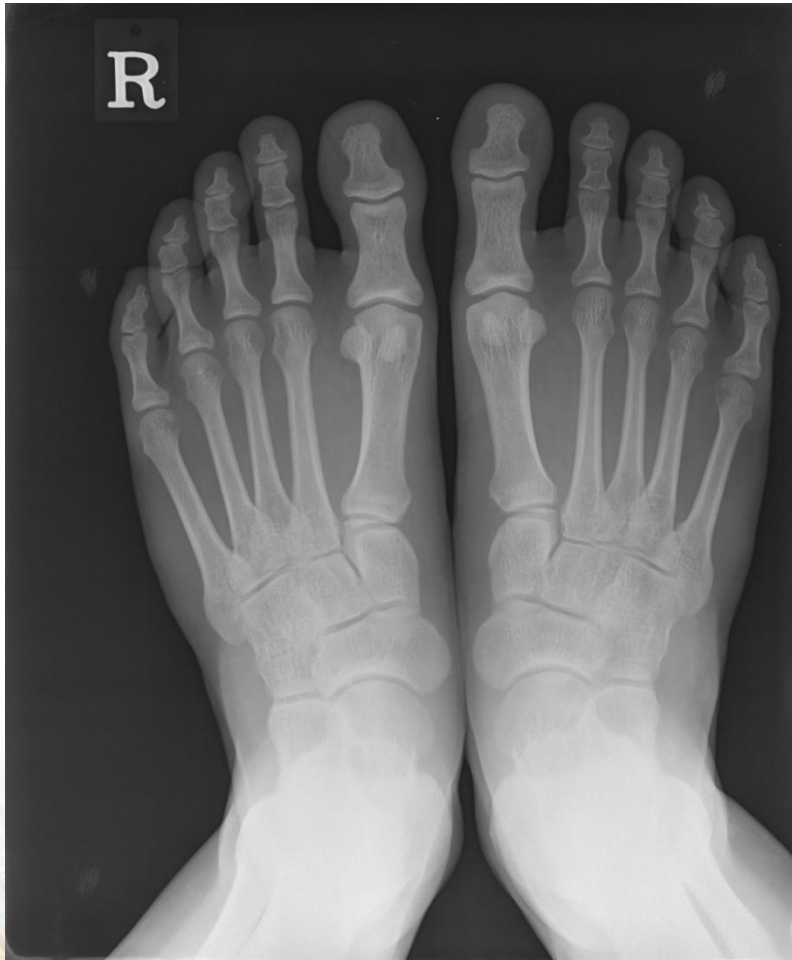




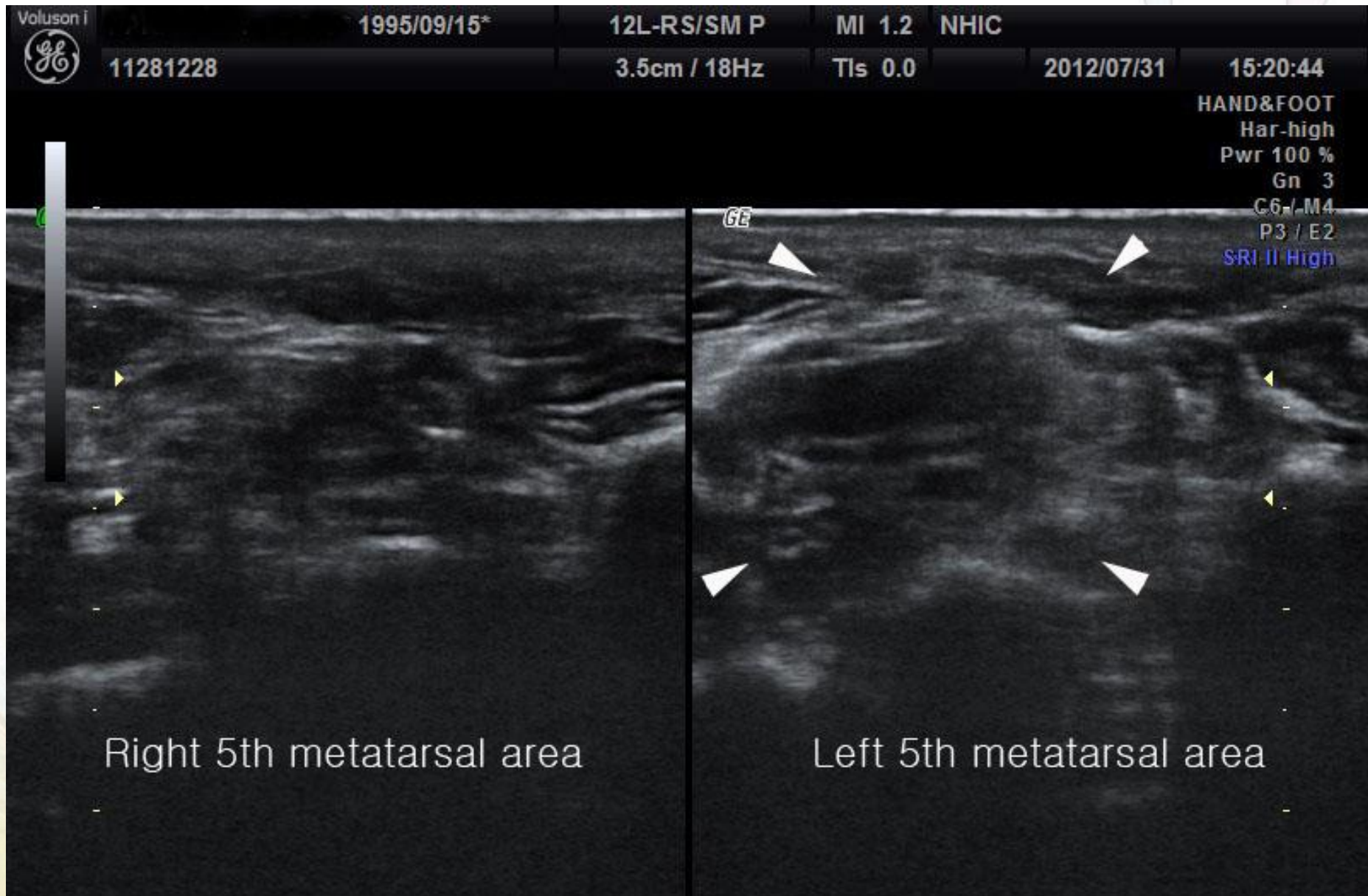


검사명		결과	Sign	하한	상한
Uric acid	Uric acid	3.8		4.8	8.7
Calcium	Calcium	10.5		8.9	10.3
P	P	8.5		2.4	4.7
r-GT	r-GT	115		7	50
Lipid Profile	Triglyceride	214		0	180
	HDL-cholesterol	40		29	71
	C-LDL cholesterol	127		0	130
CRP,quan	CRP,quan	1.86			1.00
Parathyroid hormone	Parathyroid hormone	1634		12	72
Routine CBC	WBC	7.9		3.7	10.0
	RBC	4.69		4.5	6.3
	Hb	15.8		14.0	17.0
	Hct	47.7		39.0	51.0
	MCV	101.7		80	94
	MCH	33.7		26.0	32.0
	MCHC	33.1		32	36
	RDW	15.7		11.3	15.5
	PDW	11.3		9.3	16.0
	Platelet count	215		140	400
ESR	ESR	47		0	20

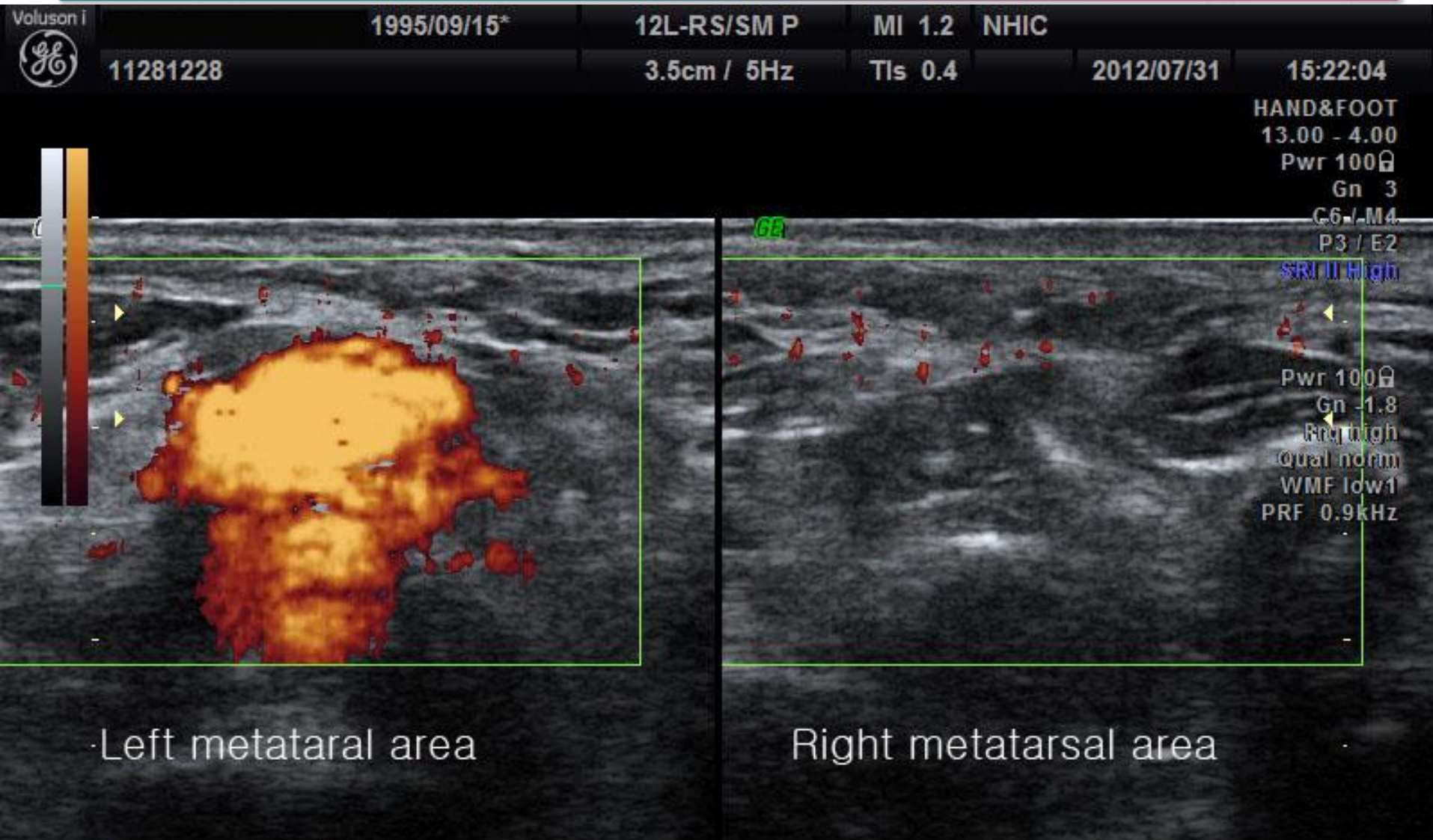
AV malformation of the foot (16-M Case)



AV malformation of the foot (16-M Case)



AV malformation of the foot (16-M Case)



AV malformation of the foot (16-M Case)

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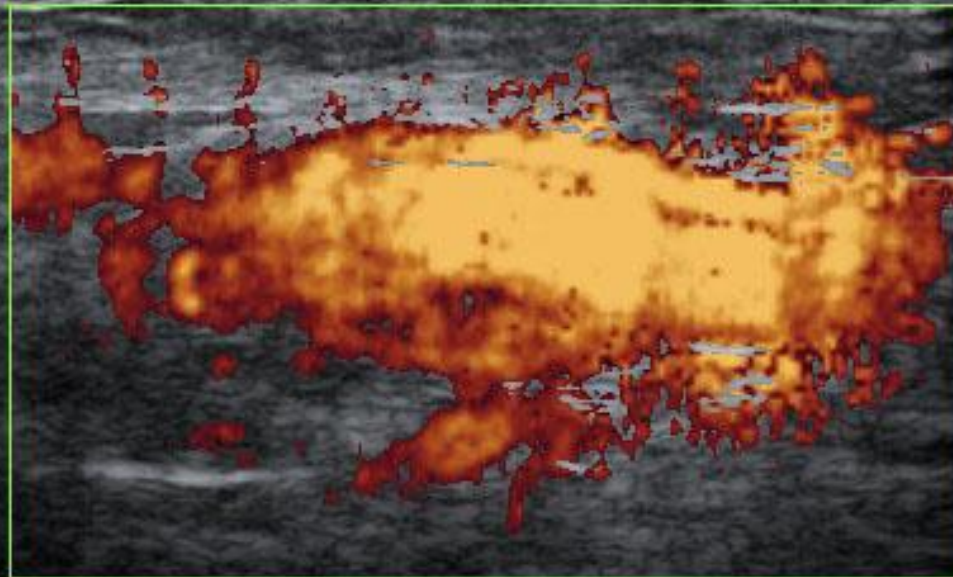
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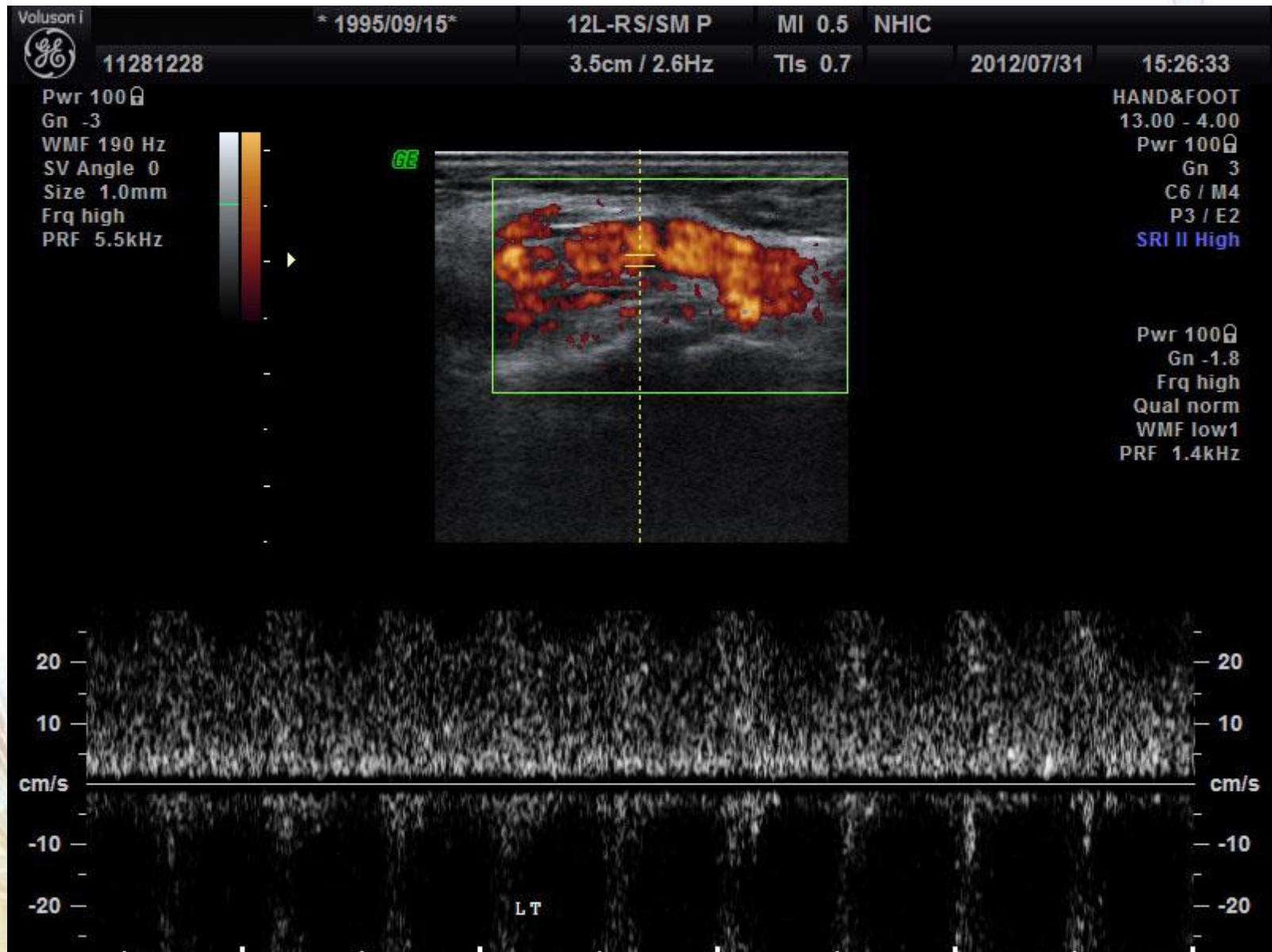


GE



Left longitudinal Power doppler

AV malformation of the foot (16-M Case)





- Considering factors
 - Age, Underlying Diseases (HTN, DM.....) , Sex, Smoking Hx
- Systemic or Focal
 - Systemic symptoms DM, Uremia, Alcohol history, Raynaud's phenomenon, Atherosclerosis Vs Radiculopathy, focal entrapment syndrome
- Evaluation Tools
 - EMG, Angiography, Doppler, Whole body thermography , L-spine MRI
- Evaluation lab
 - CBC, ESR, CRP, ANA, RF, autoantibody (Anti SCL, anticentromere Ab.....) , Complement, Protein S, Protein C, Coagulation test



