

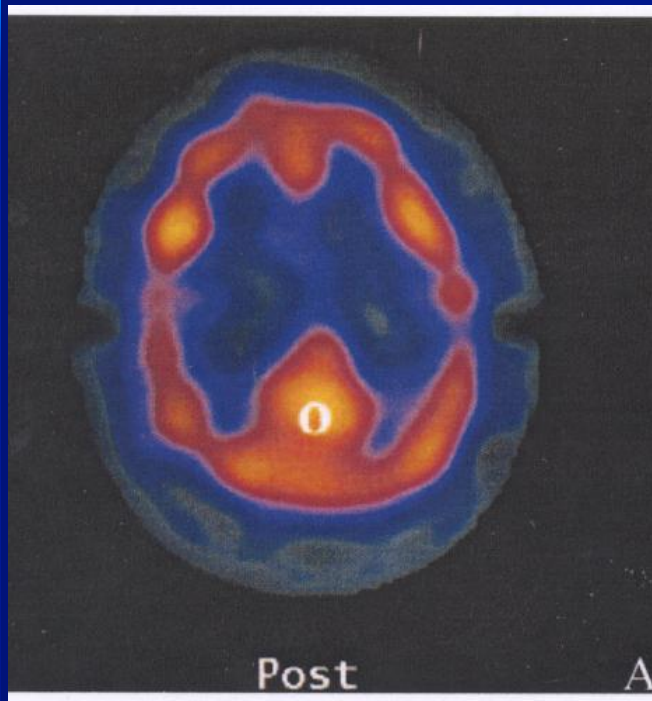
SPECT and SPECT-CT & infection and inflammation

John Buscombe

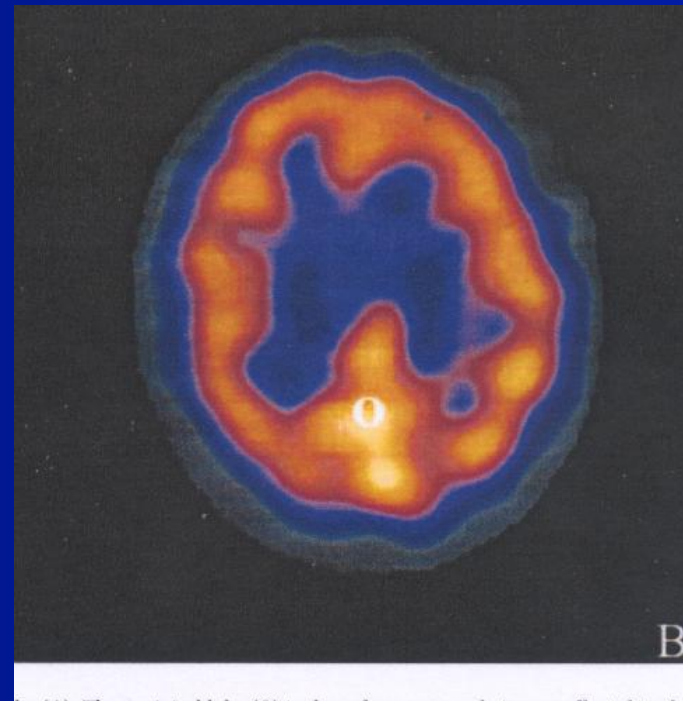
SPECT in infection

- Is there a role for SPECT?
- Is the extra time/cost justified
- Are there particular situations in which SPECT helpful
- Can be used in non specific agents looking at affect of infection on various organs
- Also used in more specific infection imaging eg Ga-67, WBCs etc

Parvovirus encephalitis treated with anti-virals



Pre-treatment



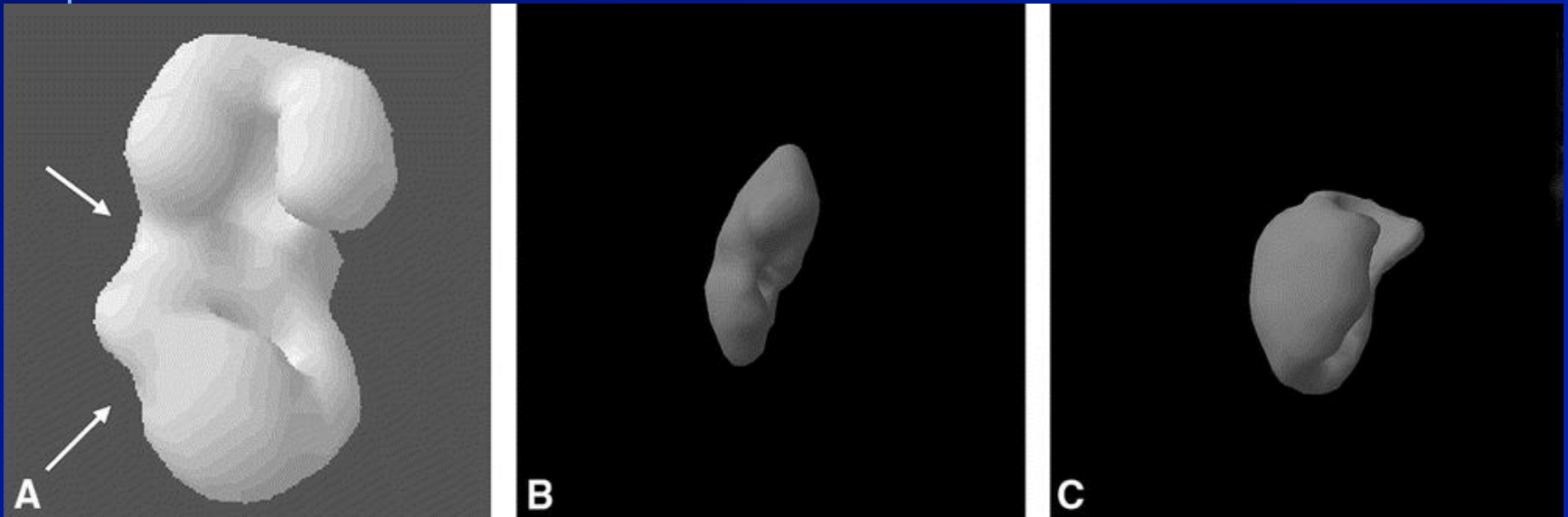
post treatment

Dupont et al Transplantation 2007

TABLE 2. Comparison of 99m Tc-DMSA SPECT findings in renal allograft recipients with and without a history of recurrent urinary tract infection.

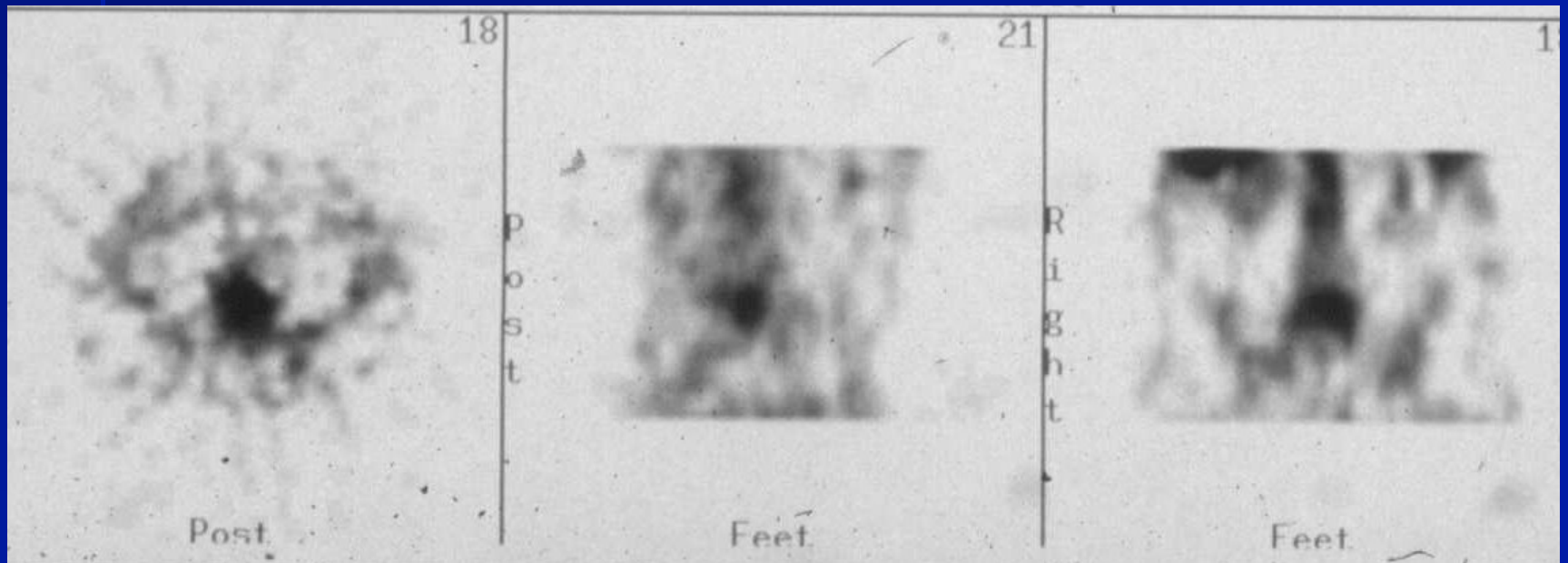
	<u>Recurrent UTIs (%)</u>		<u>Controls (%)</u>	
	Reflux	No reflux	CAN	Vascular occlusion
N	15	17	11	8
No scars	2 (13)	6 (33)	8 (73)	0 (0)
One focal defect	5 (33)	3 (18)	3 (27)	0 (0)
Two focal defects	2 (13)	3 (18)	0 (0)	0 (0)
>Two focal defects	6 (40)	5 (29)	0 (0)	0 (0)
Any focal defect	13 (87)	11 (65)	3 (27)	0 (0)
Segmental defect	0 (0)	0 (0)	0 (0)	8 (100)

Dupont et al DMSA SPECT in Tx



A=scar, B=rejection , C=vascular damage

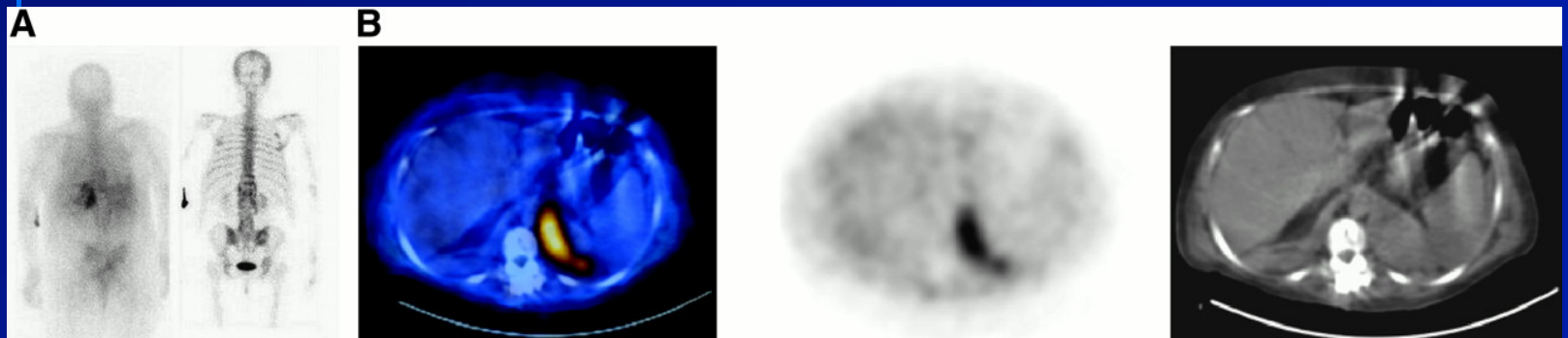
Ga-67 in E.coli spinal OM



Bar-Shalom et al JNM 2006

SPECT/CT for suspected bone infection on GS. A 56-y-old woman presented with fever, low back pain, and infected scar 1 mo after spinal surgery and was referred for GS for suspected vertebral osteomyelitis. (A) Planar posterior whole-body GS image (left) shows prominent abnormal uptake in left lower back, corresponding in part to regions of increased irregular uptake seen on planar posterior whole-body ^{99m}Tc -MDP image (right) along operated vertebrae. (B) Transaxial GS SPECT/CT image (left) localizes abnormal uptake on GS (center) to paravertebral soft-tissue abscess seen on corresponding CT image (right), thus defining soft-tissue infection without osteomyelitis. There was no evidence of vertebral osteomyelitis on follow-up CT 4 wk later

Bar-shalom et al



Tc-99m leukoscan in ?infected TKR-Quigley in press 2008

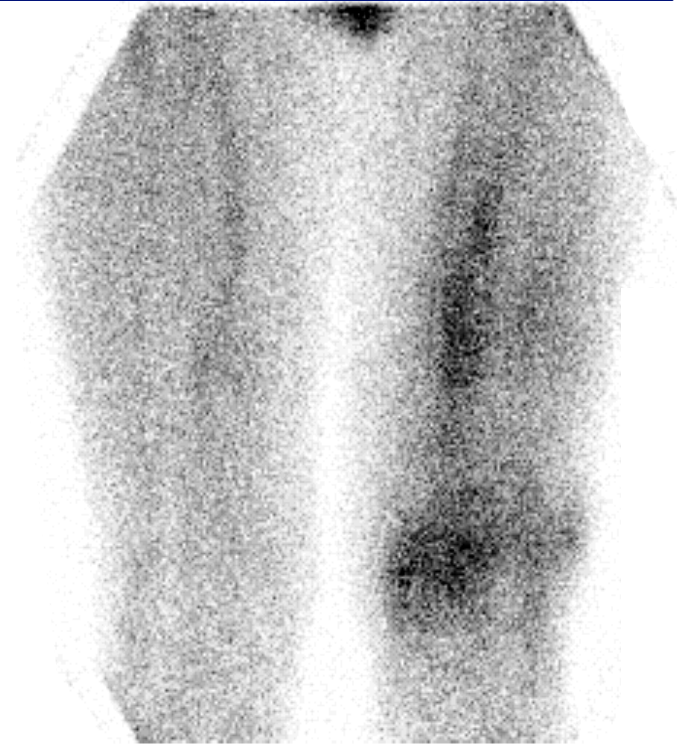
- 32 studies performed for suspected knee infection
- 28 had prosthetic joint in situ
- 4 post surgery (not TKR) or suspected primary infection
- Mean age 64 years (range 21-91)

RESULTS-Quigley et al

- 11 true positives
 - 13 true negatives
 - 3 false negatives
 - 1 false positive
 - 79% sens, 93% spec
- 4 patients: data not available (1 died before diagnosis established, no PM)



One hour



Four hours

One hour post injection



Four hours post injection



One Hour Post Injection



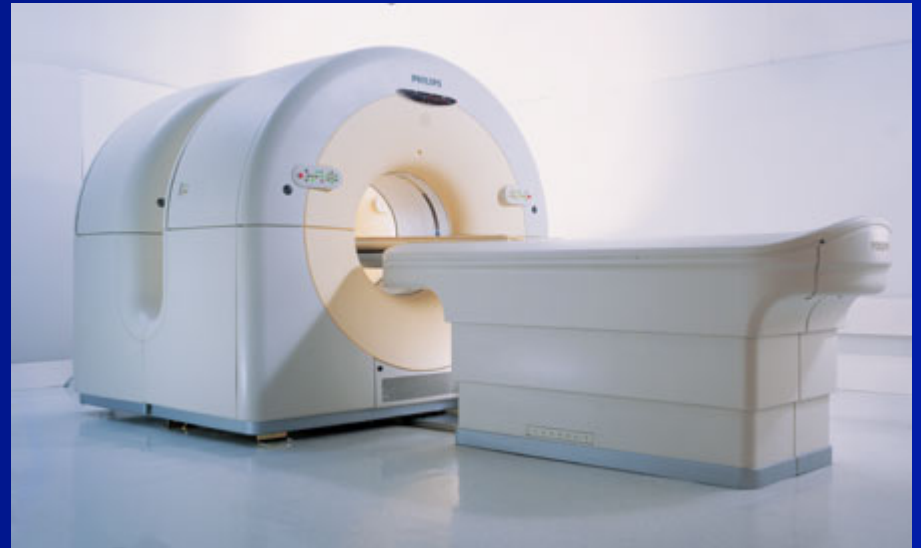
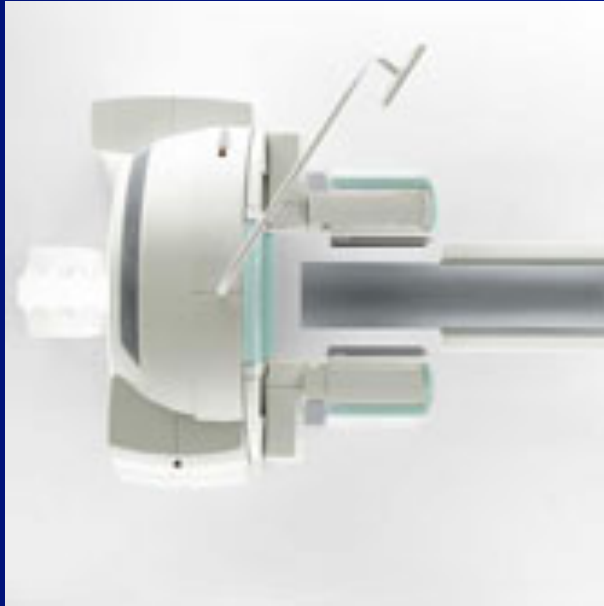
Four Hours Post Injection



Is there a role for fusion imaging in infection/inflammation

- Potential for better localisation
- Potential for improved specificity
- Is high cost justified
- Will use of machines be taken up by more “trendy” topics such as cancer
- Will it be worth the effort

SPECT-CT or PET-CT?



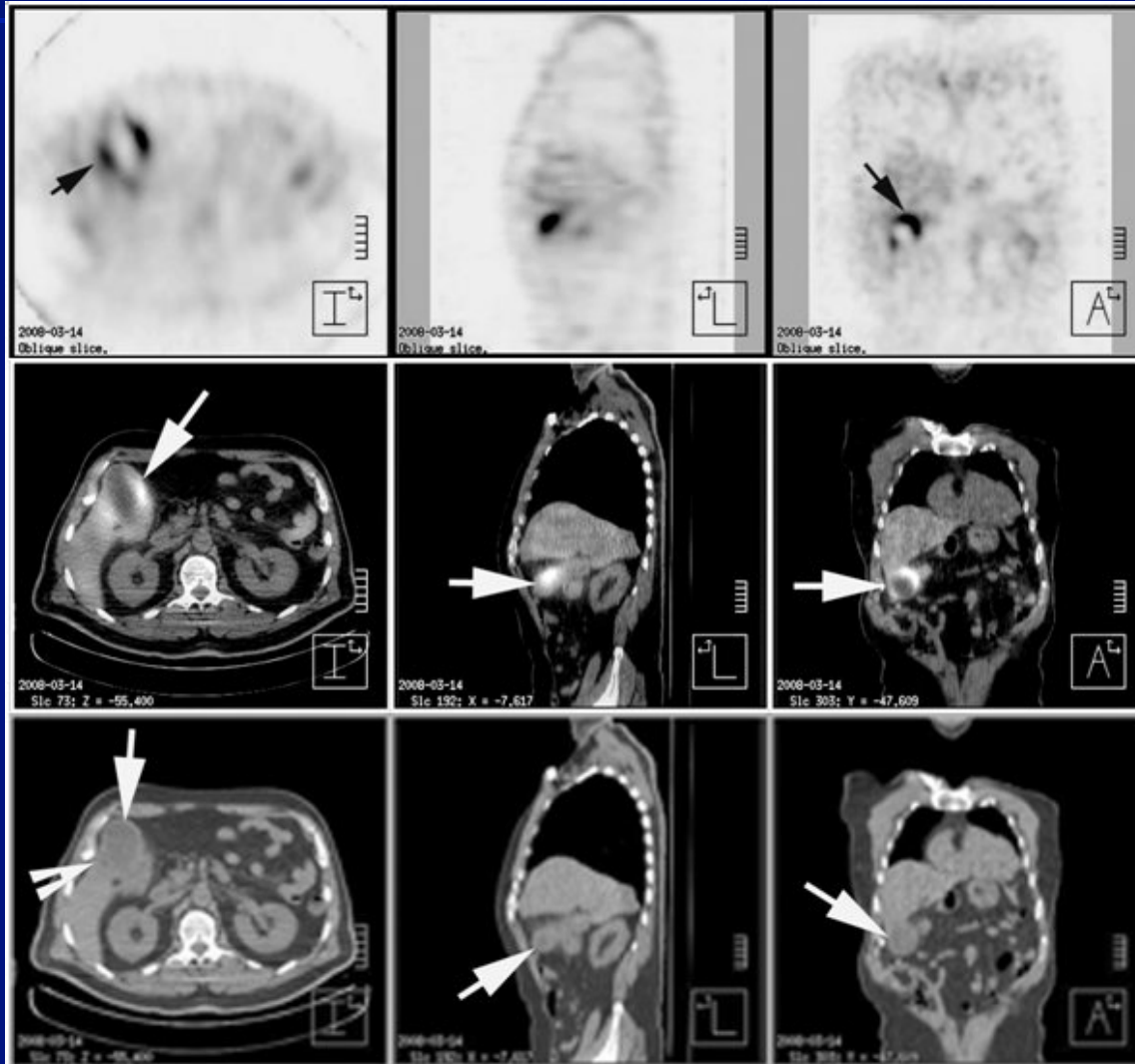
What can we do with each machine

- SPECT-CT
- Tc-99m MDP
- Ga-67
- In-111 labelled WBCs
- Tc-99m HMPAO WBCs
- Tc-99m antibodies
- PET-CT
- F-18 FDG
- F-18 WBCs

SPECT-CT

- Roach et al 2006 NMC
- Looked at 50 scans including bone and Ga-67 SPECT-CT
- 16% of patients had minor change
11% major change c/w SPECT alone
- Almost all to do with localisation and improved specificity
- Specificity itself improved by 26%

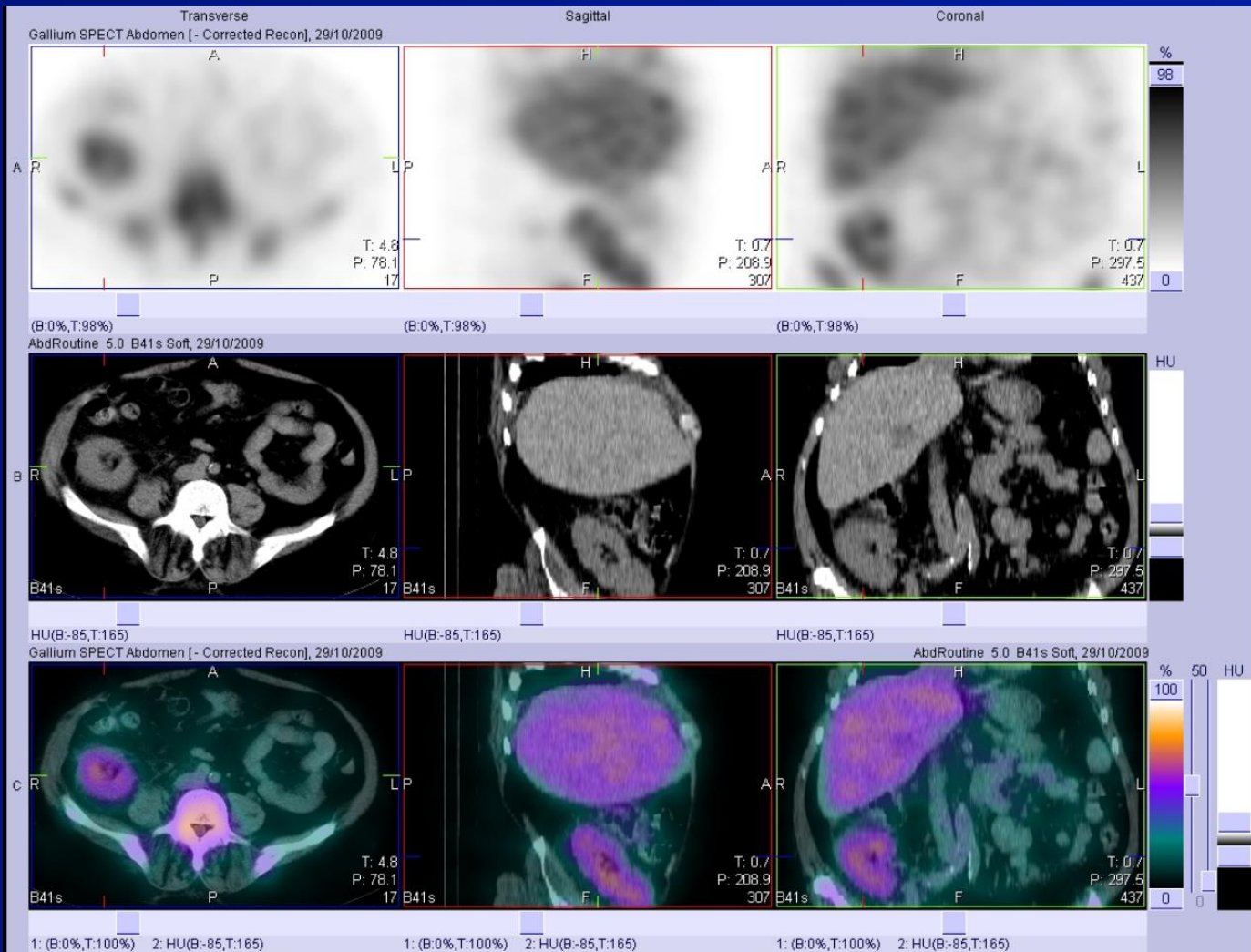
Ga-67 in gall bladder abscess Ho et al ACR



Specific results for infection

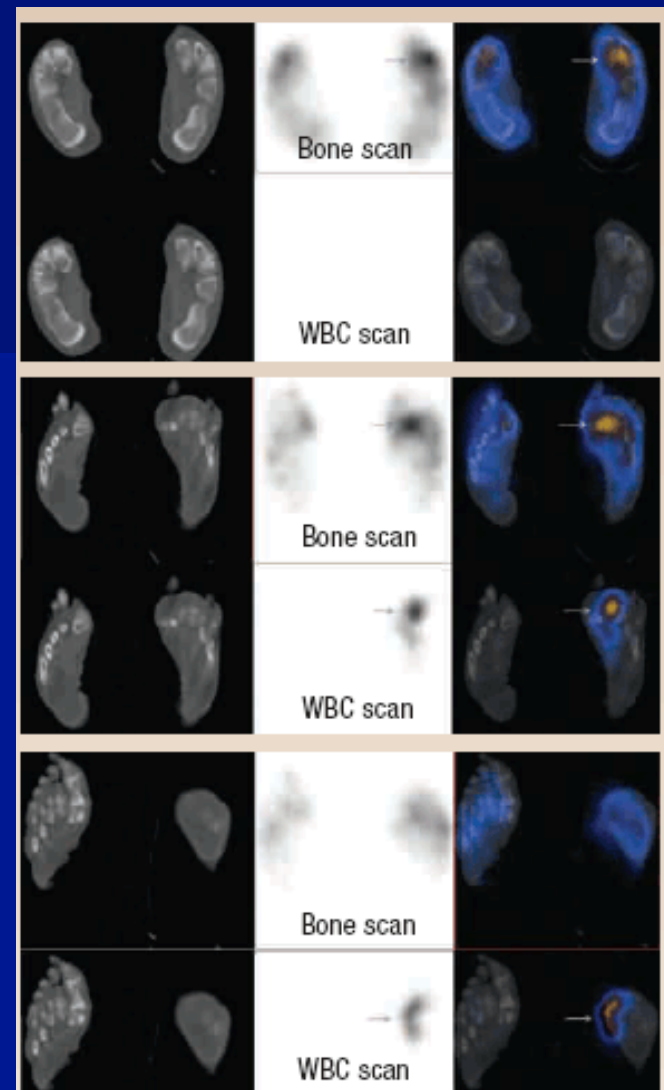
- Inquie et al J Comp Assist Tom 2007
- 16 patients (11 In-111 WBC and 6 Ga--67)
- SPECT/CT images yielded "added value" for anatomical localization in 65%, diagnostic confidence in 71%, and altered interpretations in 47% of cases

Ga-67 in infected Tx



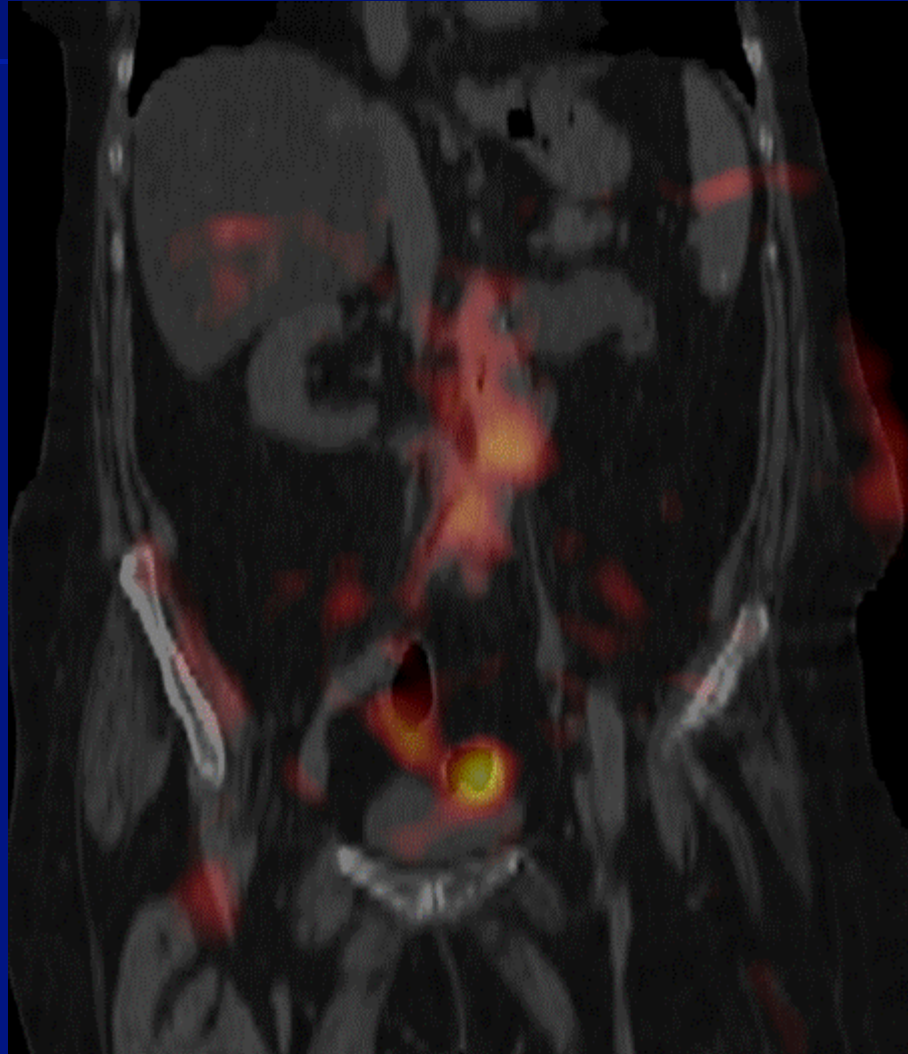
Case reports

- Most of the other publications are case reports
- Often in themselves interesting
- However poor level of evidence to convince those with the money!



Dual-isotope (Tc-99m HDP bone scan/In-111 WBC) SPECT/CT imaging confirms and localizes left medial/intermediate cuneiform arthritis (arrows in top figure) and left second metatarsal head osteomyelitis (arrows in middle figure) in diabetic patient without infection. Dual-isotope (Tc-99m HDP bone scan/In-111 WBC scan) SPECT/CT images from the same case (bottom figure) confirm and localize left plantar soft-tissue infection (arrows). (Provided by S. Heiba)

Tc-99m HMPAO WBC in infected vascular graft Held et al 2007 ACR

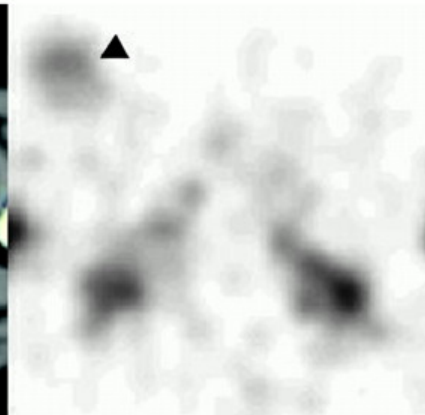
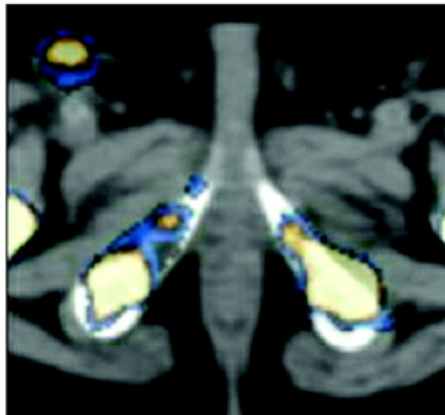


**WBC SPECT-CT showing an
infected iliac graft Bar Shalom et al
JNM 2006 48% more accurate
than planar WBC imaging**

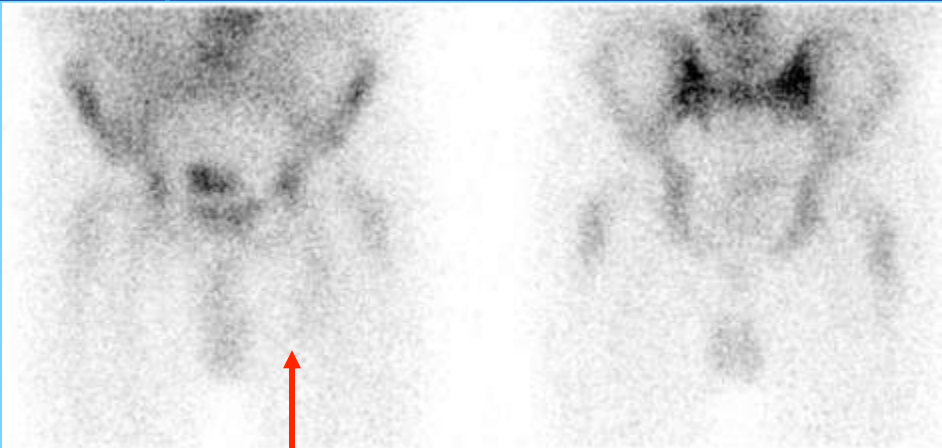
A



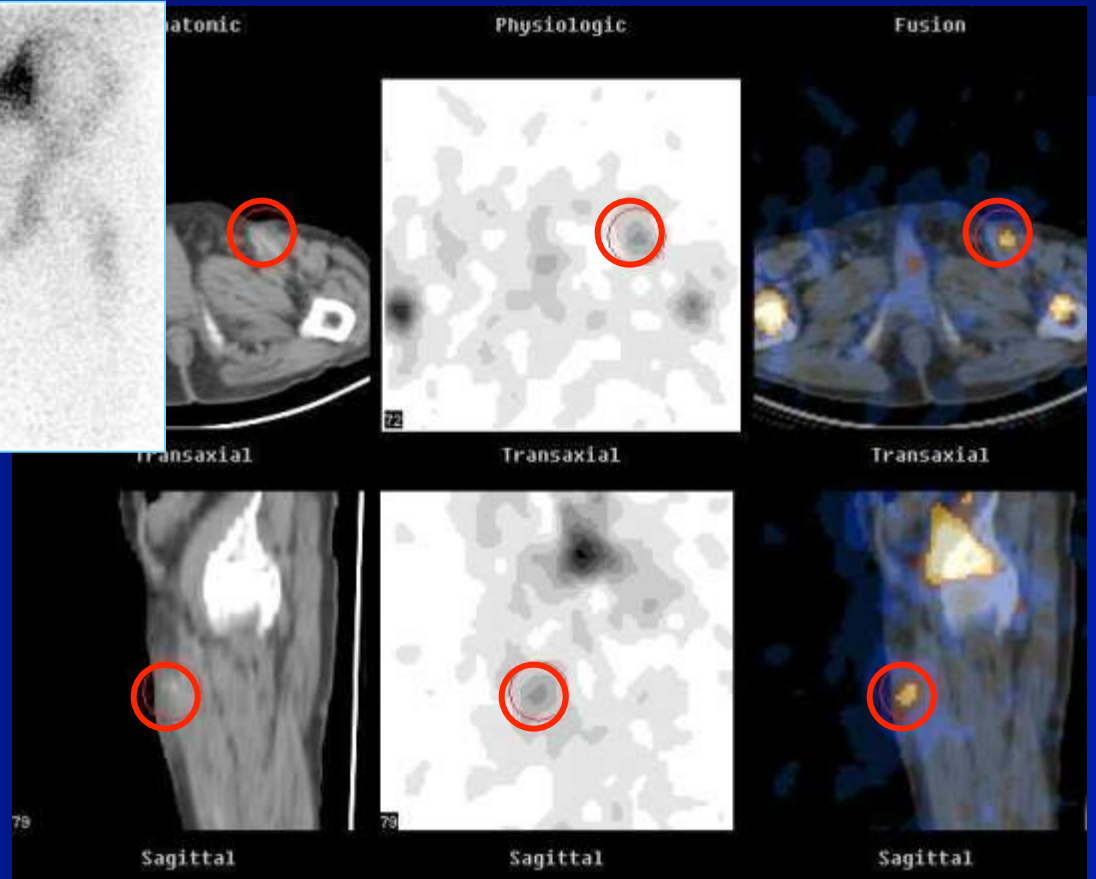
B



In-WBC Imaging of Infected Vascular Graft



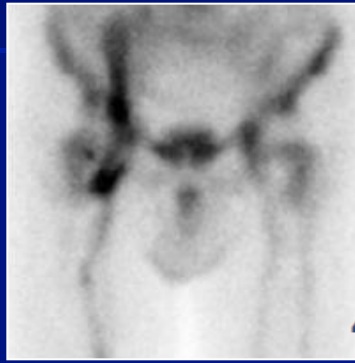
M, 57, S/a rt. fem-pop graft
Fever, leukocytosis, infected
lt. groin wound
SPECT/CT: graft involvement
confirmed at surgery



Tc-WBC Imaging of Infected Vascular Graft

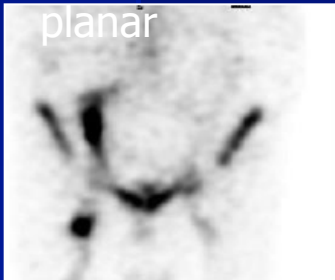


early 30min



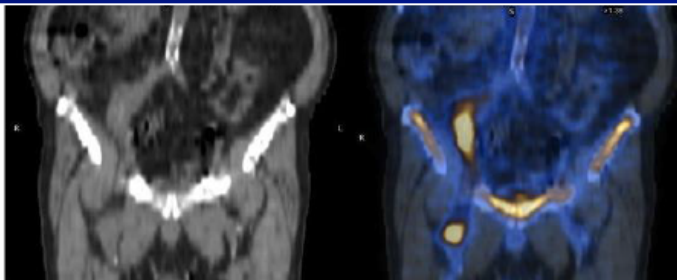
delayed 4h planar

- Rt. ilio-femoral graft
- Swelling in rt. groin
- Negative blood culture
- Planar scan: abnormal uptake rt. inguinal region, increasing in intensity



planar

SPECT



SPECT/CT

SPECT/CT: uptake localized to vascular graft

Tc-WBC scintigraphy vs conventional radiological imaging in management of late, low-grade vascular prosthesis infections

Erba et al, EJNMMI 2014

55 patients, susp. late & low grade graft infection

- ▶ Tc-WBC (planar +SPECT/CT)
- ▶ 47 graft infection, 8 extra-graft infectious foci
- ▶ Tc-WBC positive: 90% (43/47, 20/43 also extra-graft)
- ▶ SPECT/CT: reduced # FP in 37% patients

Test	Sensitivity	Specificity
SPECT	85%	63%
SPECT/CT	100%	100%
US	34%	75%
CT	49%	83%
Clinical criteria	68%	63%

The Diabetic Foot – the Value of WBC-SPECT/CT

WBC scan:

- Pros: Diagnosis of infection
- Cons: not good enough [poor] for localization (to soft tissues and/or bone)

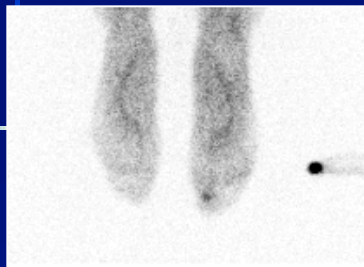
Solved with SPECT/CT!

- Single study
- Accurate spatial localization
 - extremities are less prone to motion
 - close proximity of structures in a small anatomic region
- Decreased radiation exposure; lower cost

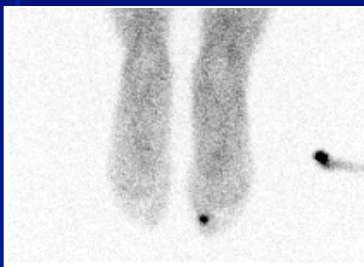
Tc-WBC SPECT/CT Diabetic Foot

Skin ulcer, pus secreting, tenderness & swelling 1st right toe

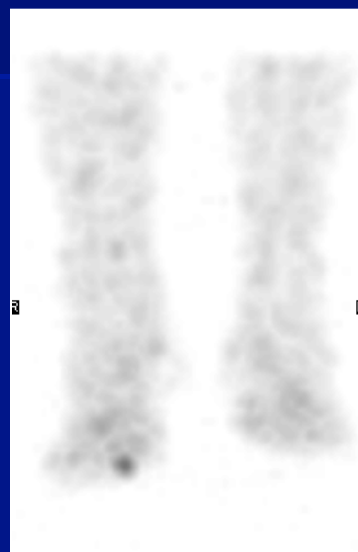
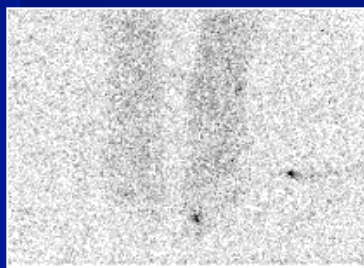
1h



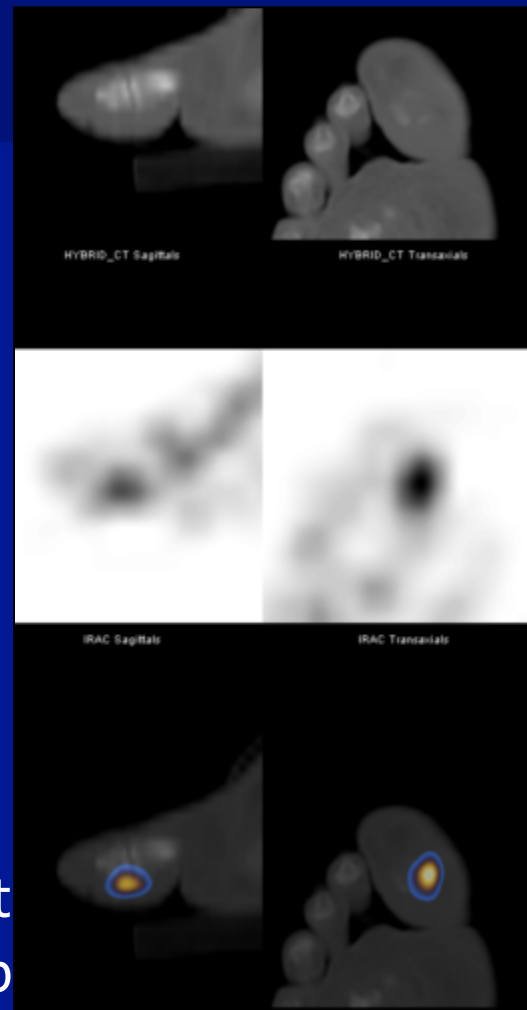
4h



24h



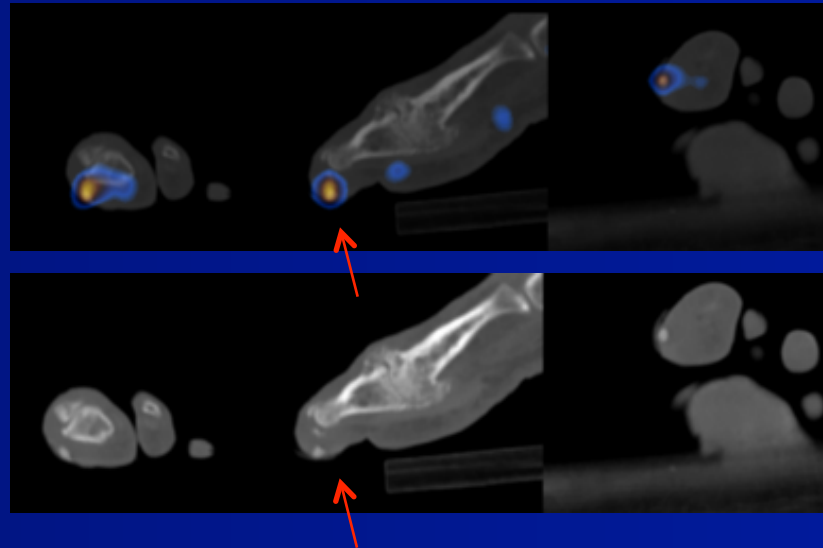
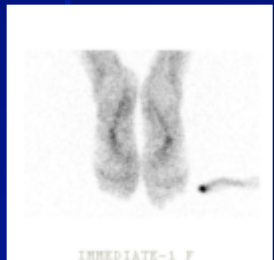
SPECT MIP



Infected soft tissue ulcer, plantar aspect 1st right toe
No evidence of osteomyelitis 5 months follow up

WBC Scan in Diabetic Foot

Potential Pitfalls



Tc-WBC uptake in hyperdense foreign body secondary to soft tissue infection – no OM!

WBC Imaging of the Diabetic Foot

Summary of Literature

Author	Year	Agent/Technique	Pts/ sites	Sensitivity	Specificity	Accuracy
Fillippi	2009	Tc-WBC/SPECT/CT	17/19	Contribution of SPECT/CT: 53%		
Heiba	2010	BS & In-WBC (SPECT/CT) ± BM	213/?	95%	94%	
Erdman	2012	Tc-WBC / SPECT/ CT	77/100	Composite severity index: prediction of outcome		
Capriotti	2006	WBC	Meta- analysis	90%	81%	
Dinh	2008	In-WBC	Meta- analysis	74%	68%	
Palestro	2009		Review	72-100%	67-98%	
<i>Asli</i>	<i>2011</i>	<i>Tc-IgG / planar</i>	<i>18/23</i>	<i>100%</i>	<i>69%</i>	<i>83%</i>

Conclusions

- Increasing evidence for use of SPECT-CT
- Main advantage is Specificity
- May be some improvement in sensitivity
- Can be used with Ga-67, labelled WBCs and ABs