Temporal Bone Osteomylytis

Reporter:　R 張廷碩

Case Presentation

History

- 79-year-old female
- Right otorrhea and otalgia for 4 months.
- Visited 陽明hospital
- 外院temporal bone CT: soft tissue density in right EAC (with destruction of posterior EAC) and mastoid air cells

History

- Pus culture: *Aspergillus.*
- Biopsy of right ear canal tissue :

  Sequestrum, inflammatory exudates, and keratin.
- Tarivid, Mycomb, and Augmentin

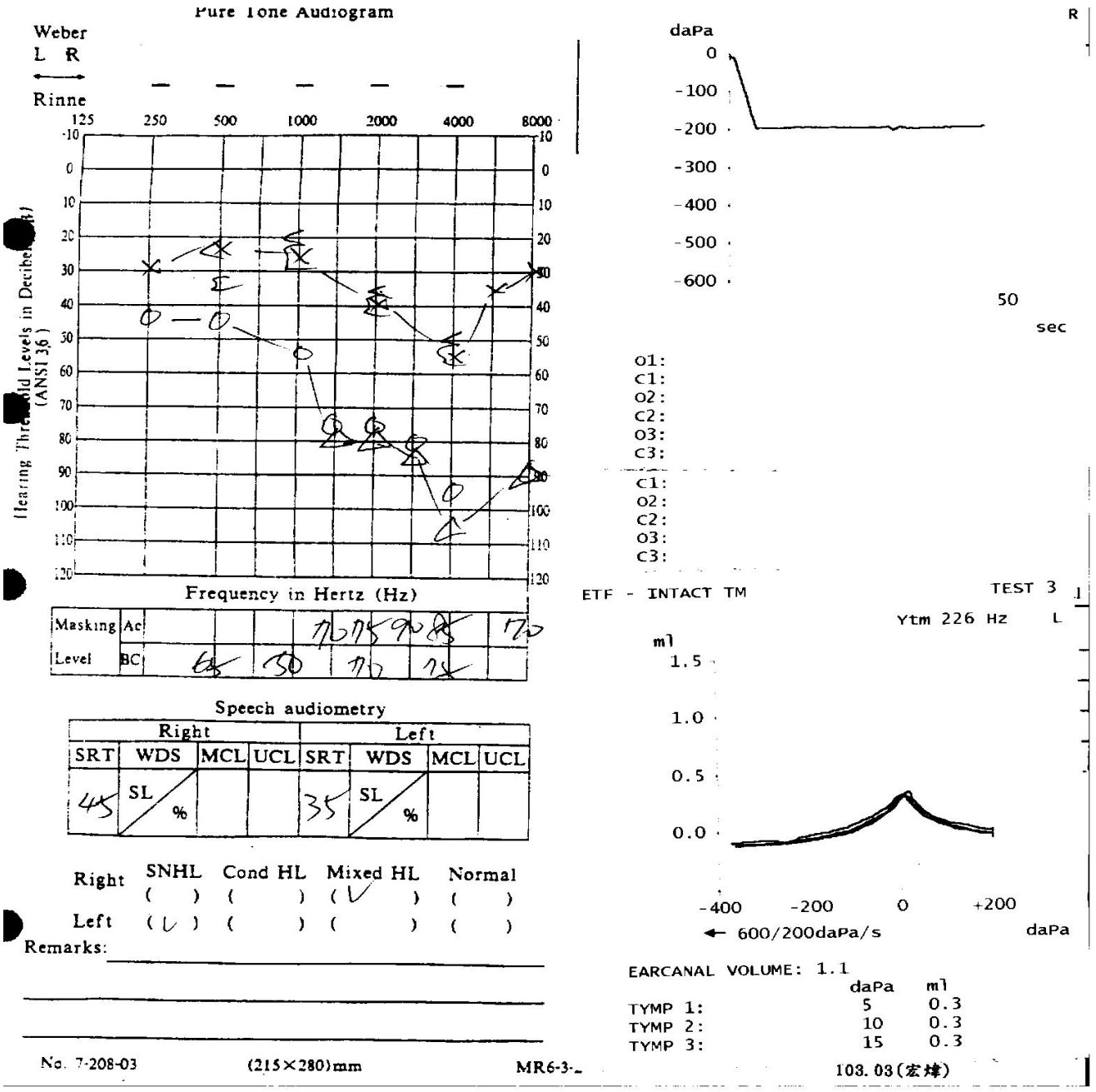
→Right otalgia became less in intensity but otorrhea persisted.

- Transferred to our EAR OPD on 2014.6.17

→Admission; Start Cefa+Genta

Physical Examination

- RIGHT EARDRUM 80% PERFORATION WITH BONY EXPOSURE OVER EAC FLOOR AND GRANULATION.


Pure Tone Audiogram
Weber
L R
Rinne
125 250 500 1000 2000 4000 8000
Hearing Threshold Levels in Decibels (ANSI 36)
Frequency in Hertz (Hz)
Masking Level
AC
BC
Speech audiometry
Right
Left
SRT WDS MCL UCL SRT WDS MCL UCL
45
35
SL
%
Right SNHL ( ) Cond HL ( ) Mixed HL ( ) Normal ( )
Left ( ) ( ) ( ) ( )
Remarks:
No. 7-208-03 (215×280)mm MR6-3-
daPa
0
-100
-200
-300
-400
-500
-600
R
50
sec
O1:
C1:
O2:
C2:
O3:
C3:
C1:
O2:
C2:
O3:
C3:
ETF - INTACT TM
TEST 3
Ytm 226 Hz L
ml
1.5
1.0
0.5
0.0
-400 -200 0 +200
600/200daPa/s
daPa
EARCANAL VOLUME: 1.1
daPa ml
TYMP 1: 5 0.3
TYMP 2: 10 0.3
TYMP 3: 15 0.3
103.03(宏烽)

Lab Data

- 6/18: WBC:5200 SEG:55.1% ESR:33 CRP=0.07

Culture

- 2014.6.18 Ordinary Culture

→Mold

- 2014.6.18 Acid Fast Stain

→(-)

- 2014.6.23 Fungus Culture

→Aspergillus niger

- 2014.6.26: Ordinary Culture (during OP)

→Mold

Osteomyelitis Scan (6/19)

- The blood flow and blood pooling phases

→Increased blood flow in Rt mastoid region.

→No obvious abnormal blood pooling in Rt mastoid region.

- The delayed bone study

→Intense uptake in Rt mastoid, with some infiltration in the air-cell in the corregistered CT.

- The gallium study

→Abnormal gallium uptake in the Rt mastoid region suggesting inflammatory process.

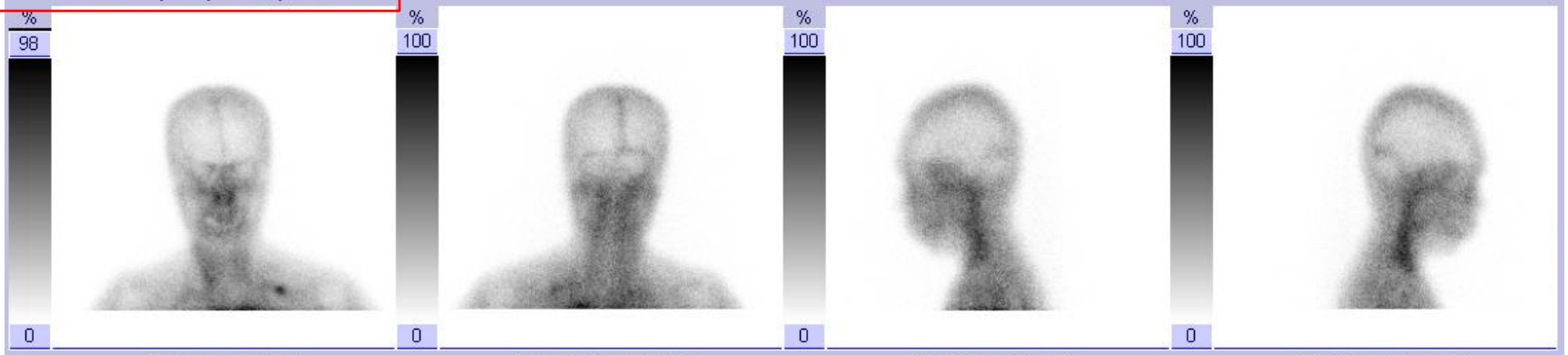
- **Impression: Rt mastoiditis and/or osteomyelitis**

台北榮民總醫院
Taipei Veterans General Hospital

Study Date: 6/19/2014
Series Time: 8:44:22 AM
Operator Name: cylee

北榮核醫
NMED VGHTPE

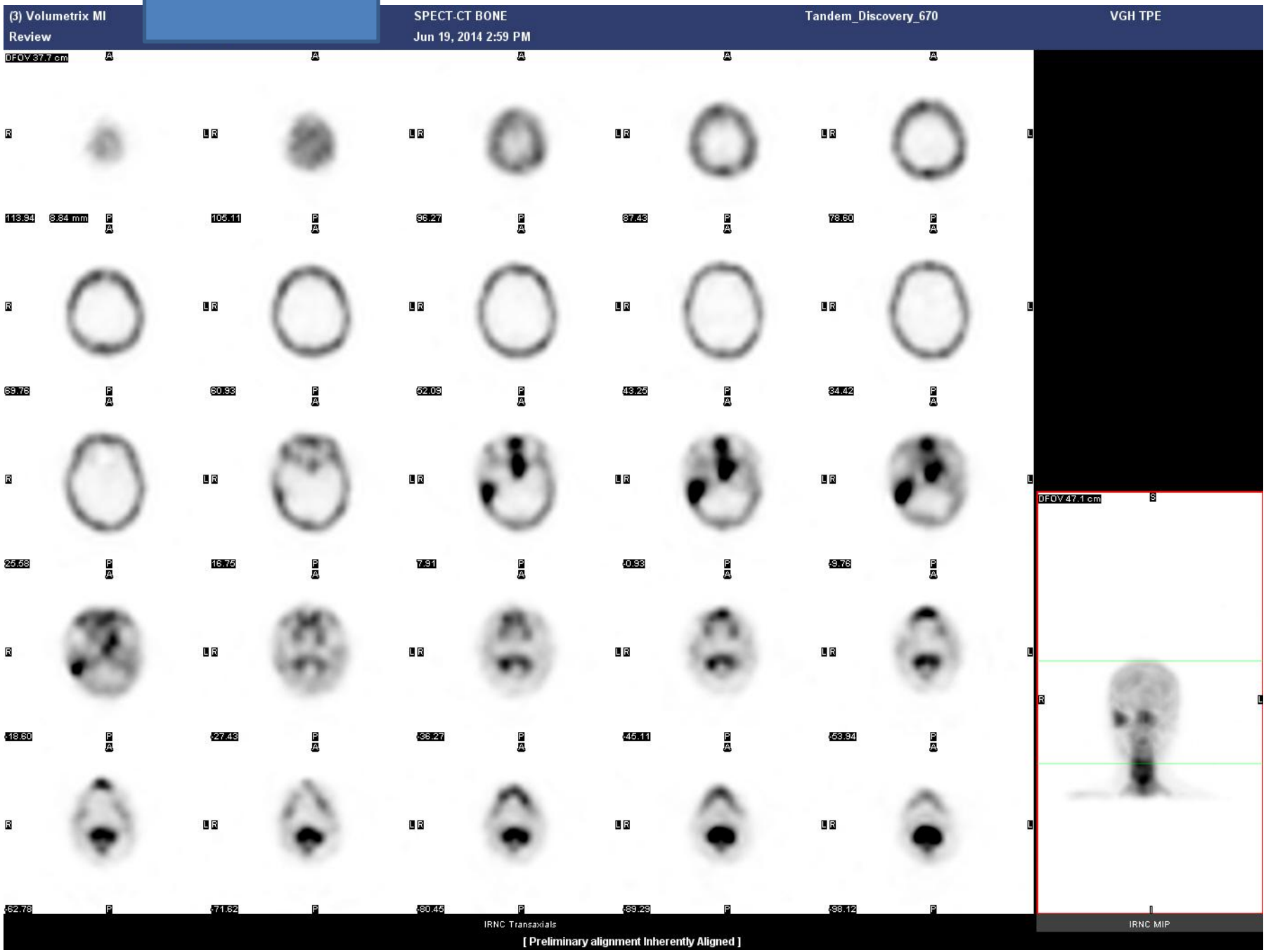
Tc-MDP Static (Early Phase) 6/19/2014

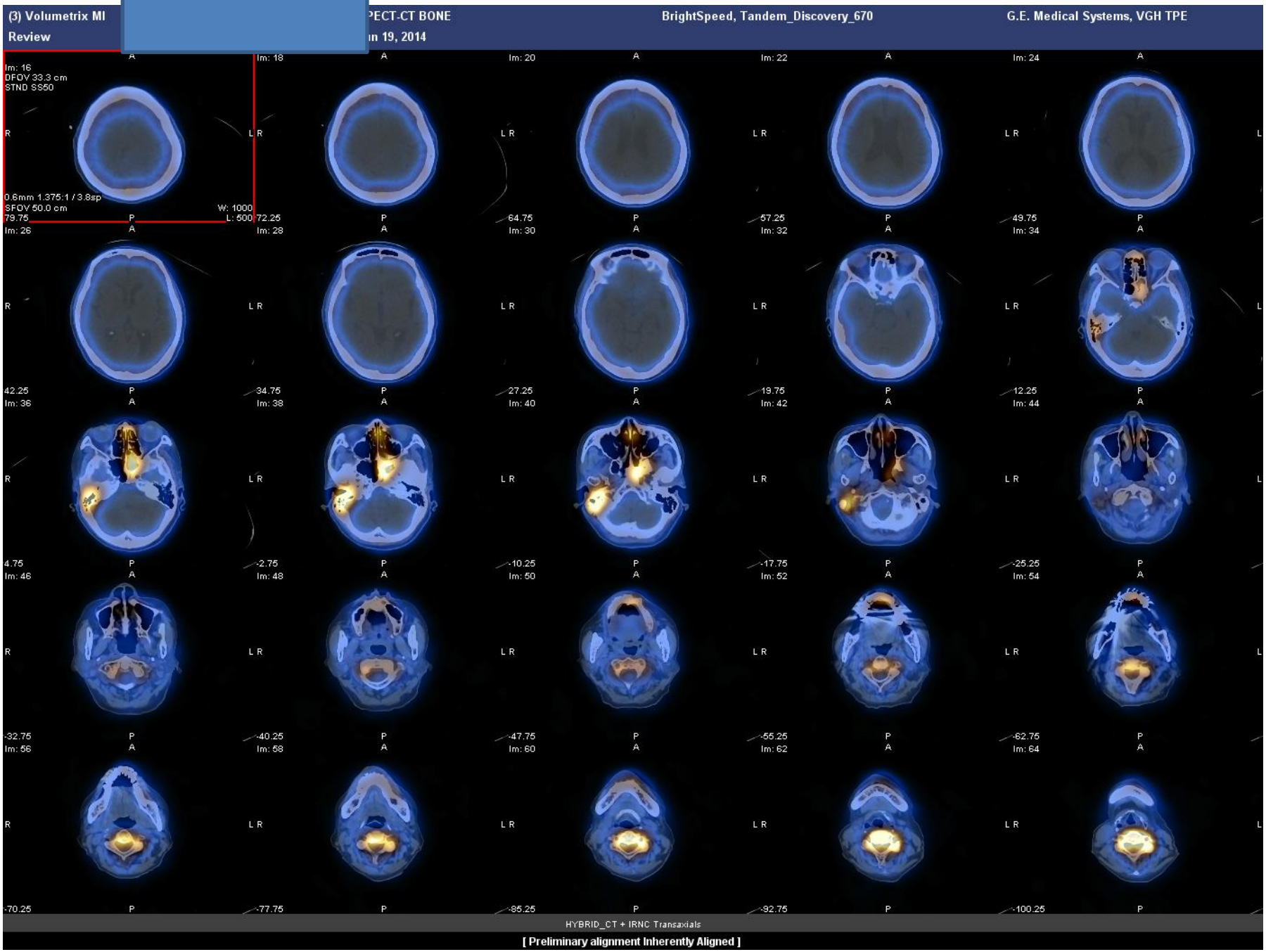


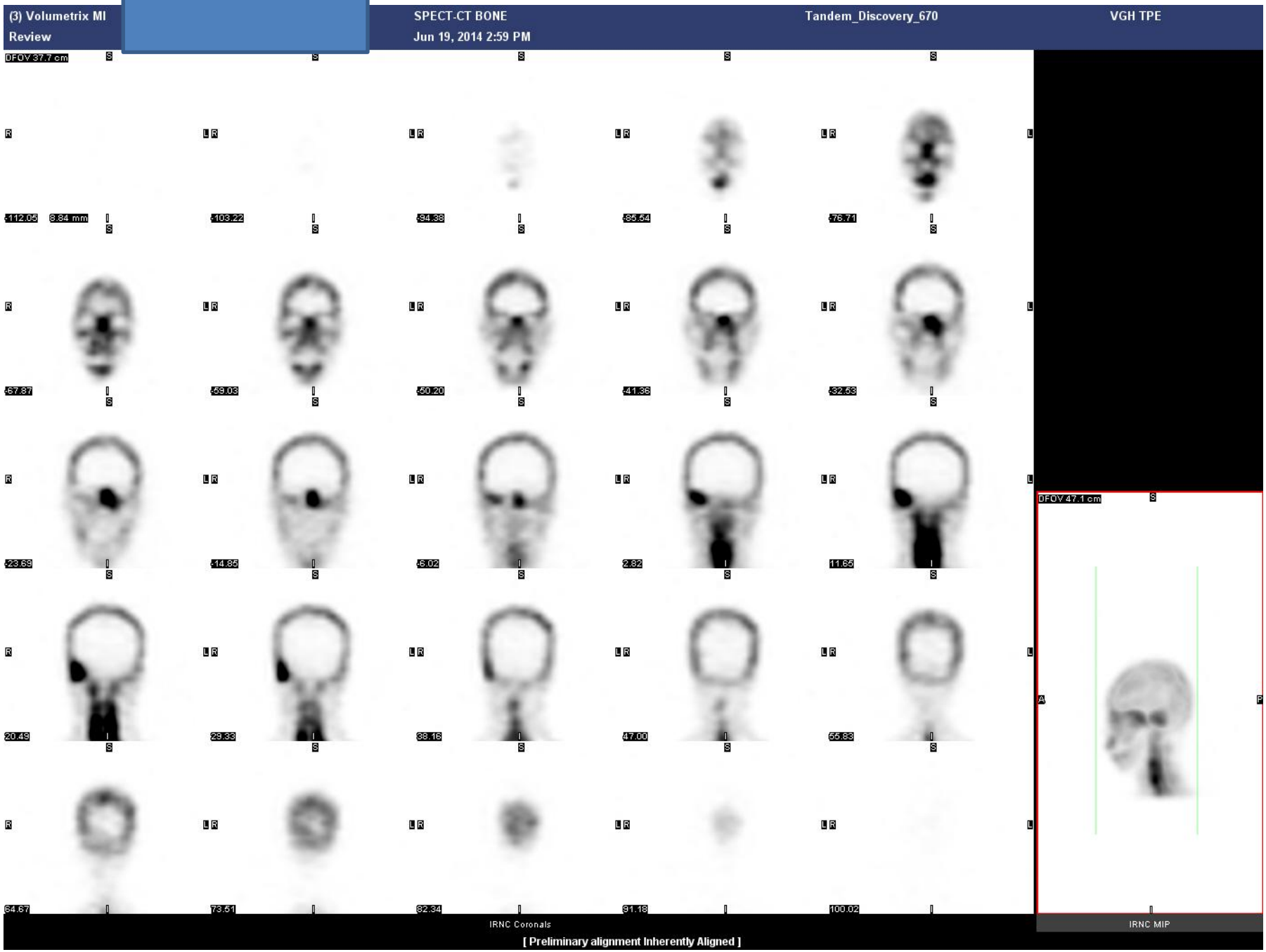
All Images

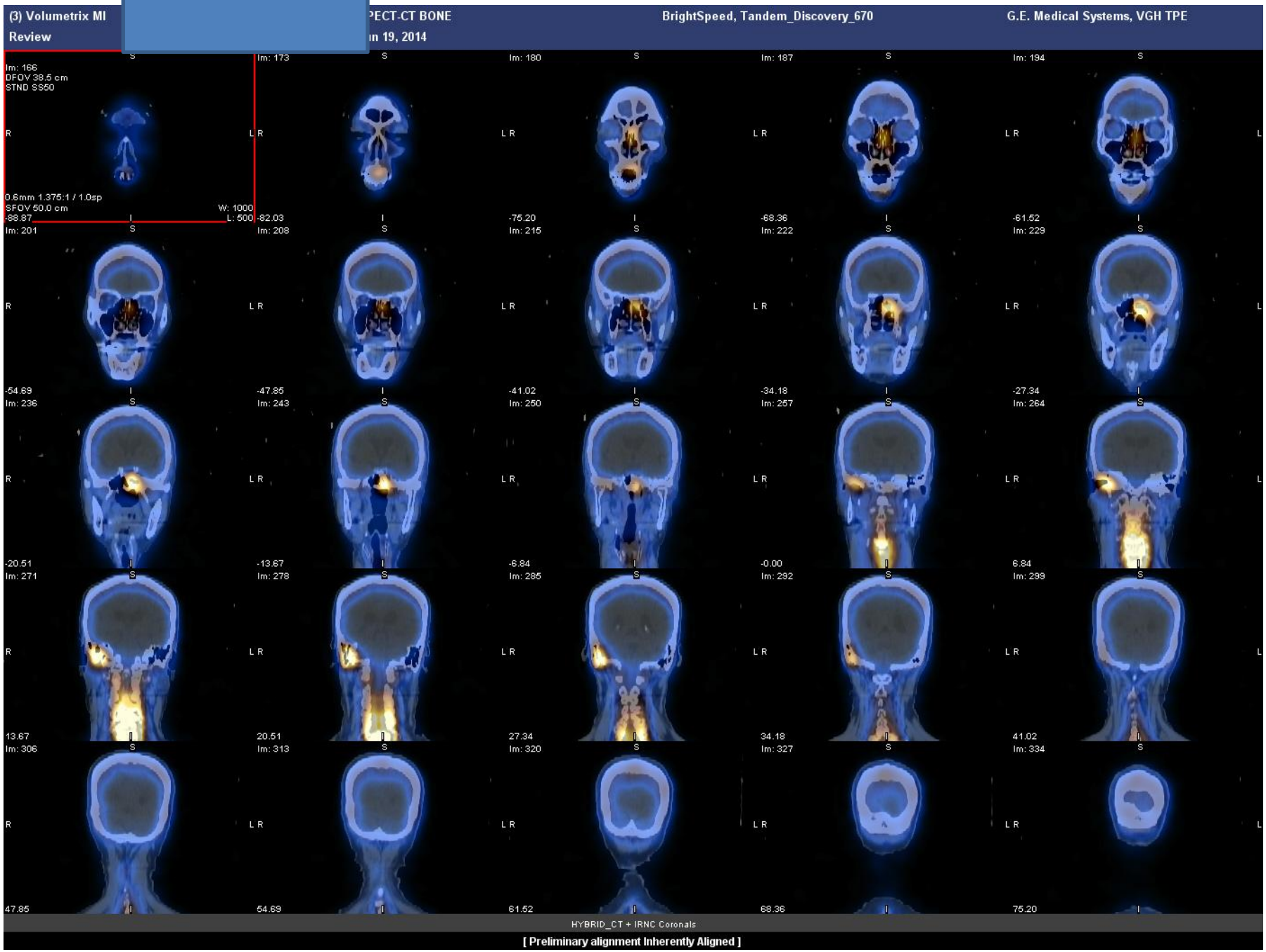
Tc-MDP Static (Delay Phase) 6/19/2014

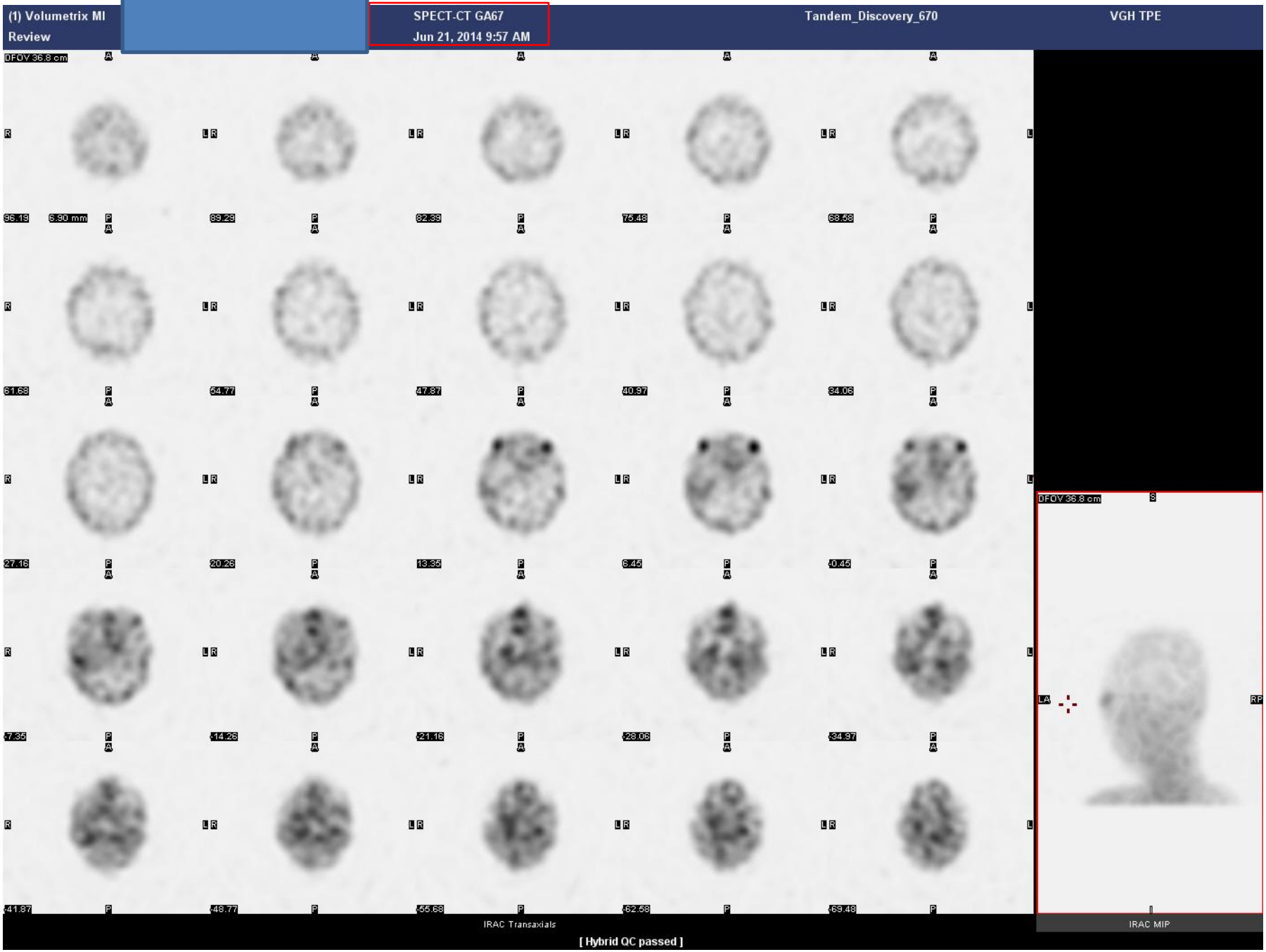
All Images


(3) Volumetrix MI
Review
SPECT-CT BONE
Jun 19, 2014 2:59 PM
Tandem_Discovery_670
VGH TPE
DFOV 37.7 cm
113.94
8.84 mm
105.11
96.27
87.43
78.60
69.76
60.93
52.09
43.25
34.42
25.58
16.75
7.91
-0.93
-9.76
-18.60
-27.43
-36.27
-45.11
-53.94
-62.78
-71.62
-80.45
-89.29
-98.12
DFOV 47.1 cm
IRNC Transaxials
IRNC MIP
[Preliminary alignment Inherently Aligned]


(3) Volumetrix MI
Review
PECT-CT BONE
n 19, 2014
BrightSpeed, Tandem_Discovery_670
G.E. Medical Systems, VGH TPE
Im: 16
DFOV 33.3 cm
STND SS50
0.6mm 1.375:1 / 3.8sp
SFOV 50.0 cm
W: 1000
L: 500
79.75
Im: 26
72.25
Im: 28
64.75
Im: 30
57.25
Im: 32
49.75
Im: 34
42.25
Im: 36
34.75
Im: 38
27.25
Im: 40
19.75
Im: 42
12.25
Im: 44
4.75
Im: 46
-2.75
Im: 48
-10.25
Im: 50
-17.75
Im: 52
-25.25
Im: 54
-32.75
Im: 56
-40.25
Im: 58
-47.75
Im: 60
-55.25
Im: 62
-62.75
Im: 64
-70.25
-77.75
-85.25
-92.75
-100.25
HYBRID_CT + IRNC Transaxials
[Preliminary alignment Inherently Aligned]


(3) Volumetrix MI
Review
SPECT-CT BONE
Jun 19, 2014 2:59 PM
Tandem_Discovery_670
VGH TPE
DFOV 37.7 cm
-112.05
8.84 mm
-103.22
-94.38
-85.54
-76.71
-67.87
-59.03
-50.20
-41.36
-32.53
-23.69
-14.85
-6.02
2.82
11.65
20.49
29.33
38.18
47.00
55.83
64.67
73.51
82.34
91.18
100.02
IRNC Coronals
DFOV 47.1 cm
IRNC MIP
[Preliminary alignment Inherently Aligned]


(3) Volumetrix MI
Review
PECT-CT BONE
n 19, 2014
BrightSpeed, Tandem_Discovery_670
G.E. Medical Systems, VGH TPE
Im: 166
DFOV 38.5 cm
STND SS50
0.6mm 1.375:1 / 1.0sp
SFOV 50.0 cm
W: 1000
L: 500
-88.87
Im: 201
Im: 173
-82.03
Im: 208
Im: 180
-75.20
Im: 215
Im: 187
-68.36
Im: 222
Im: 194
-61.52
Im: 229
-54.69
Im: 236
-47.85
Im: 243
-41.02
Im: 250
-34.18
Im: 257
-27.34
Im: 264
-20.51
Im: 271
-13.67
Im: 278
-6.84
Im: 285
-0.00
Im: 292
6.84
Im: 299
13.67
Im: 306
20.51
Im: 313
27.34
Im: 320
34.18
Im: 327
41.02
Im: 334
47.85
54.69
61.52
68.36
75.20
HYBRID_CT + IRNC Coronals
[Preliminary alignment Inherently Aligned]


(1) Volumetrix MI
Review
SPECT-CT GA67
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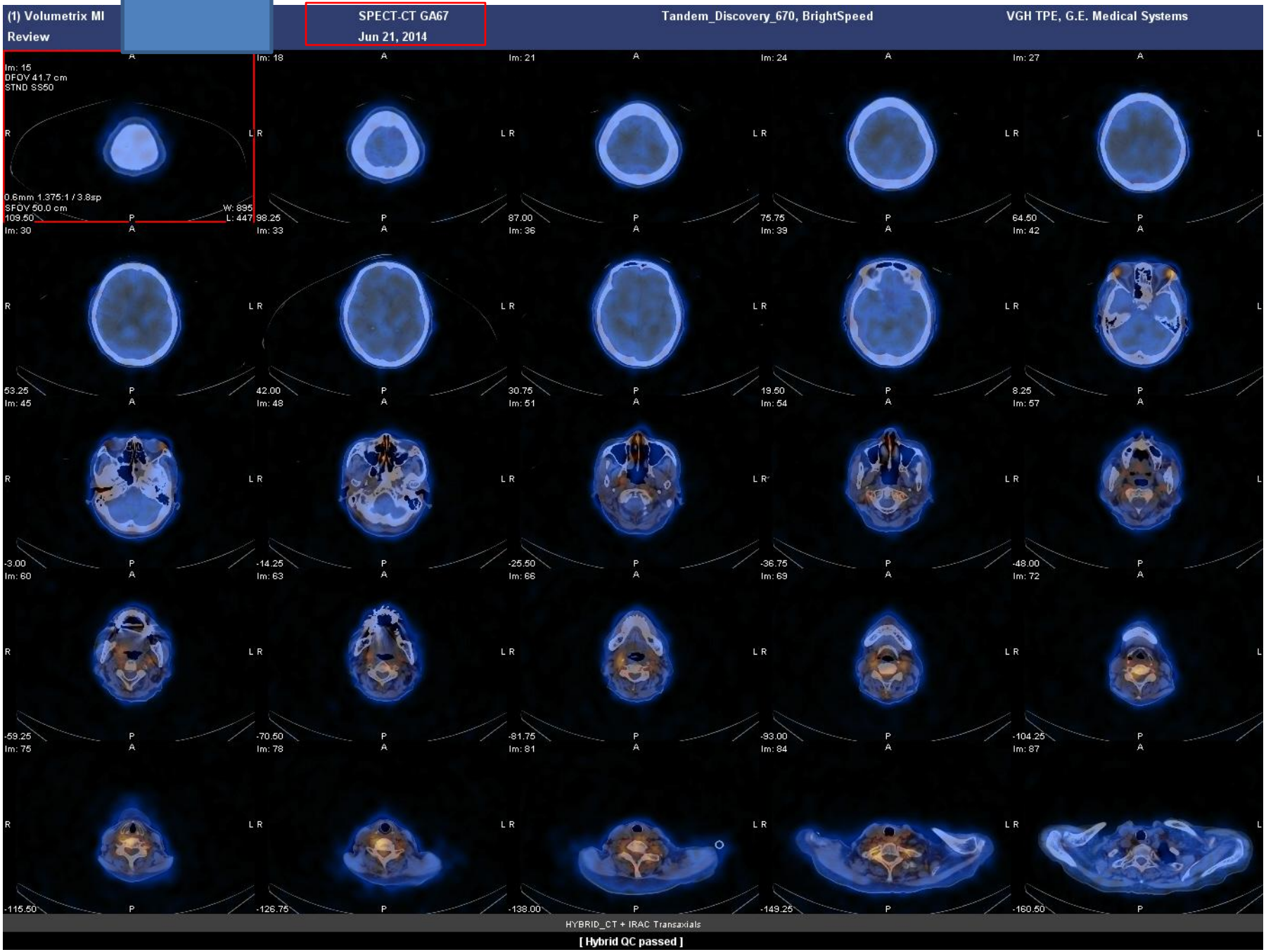
Tandem_Discovery_670
VGH TPE
DFOV 36.8 cm
96.19
6.90 mm
89.29
82.39
75.48
68.58
61.68
54.77
47.87
40.97
34.06
27.16
20.26
13.35
6.45
-0.45
-7.35
-14.26
-21.16
-28.06
-34.97
-41.87
-48.77
-55.68
-62.58
-69.48
IRAC Transaxials
DFOV 36.8 cm
IRAC MIP
[Hybrid QC passed]


(1) Volumetrix MI
Review
SPECT-CT GA67
Jun 21, 2014
Tandem_Discovery_670, BrightSpeed
VGH TPE, G.E. Medical Systems
Im: 15
DFOV 41.7 cm
STND SS50
0.6mm 1.375:1 / 3.8sp
SFOV 50.0 cm
W: 895
L: 447
109.50
Im: 30
98.25
Im: 33
87.00
Im: 36
75.75
Im: 39
64.50
Im: 42
53.25
Im: 45
42.00
Im: 48
30.75
Im: 51
19.50
Im: 54
8.25
Im: 57
-3.00
Im: 60
-14.25
Im: 63
-25.50
Im: 66
-36.75
Im: 69
-48.00
Im: 72
-59.25
Im: 75
-70.50
Im: 78
-81.75
Im: 81
-93.00
Im: 84
-104.25
Im: 87
-115.50
-126.75
-138.00
-149.25
-160.50
HYBRID_CT + IRAC Transaxials
[Hybrid QC passed]

6/26 OP

- SOFT TISSUE, R/O TUMOR, R/O GRANULATION TISSUE, WITH BARE BONE EXPOSURE WAS FOUND IN POSTERIOR-INFERIOR EAR CANAL.
- 80% EARDRUM PERFORATION AND EDEMATOUS MIDDLE EAR MUCOSA WERE NOTED.
- THE DISEASED MUCOSA, SOFT TISSUE AND NECROTIC BONE WERE REMOVED AND SENT FOR PATHOLOGY

Pathology

- 2014.6.26: Right ear necrotic tissue biopsy

→Chronic inflammation

- 2014.6.27: R/O Right ear tumor biopsy

→Chronic inflammation

Impression

- Right **chronic otitis media with chronic mastoiditis**, suspect **osteomyelitis**, status post intravenous antibiotics use and exploratory tympanotomy

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www.thesurgeon.net

Malignant otitis externa: An Australian case series

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A B S T R A C T

Objectives: To establish a clinicopathological profile of malignant otitis externa (MOE) in an Australian tertiary referral institution.

Study Design: Retrospective cohort outcomes study.

Methods: 24 patients were identified with MOE between January 1998 and July 2007. Patients were classified into Radiological Grades I–IV. Laboratory investigations Including C–reactive protein (CRP), white cell count (WCC), glycosylated haemoglobin (HBA1c) and average glucose level over admission were recorded.

Results: Radiological Grade was significantly associated with duration of therapy (rank correlation 0.57, $p = 0.004$). CRP was a useful indicator confirming disease resolution. Diabetics with MOE had elevated average blood sugar levels during their Hospital admission ($p < 0.001$) and had poor overall glycaemic control represented by Elevated HBA1c scores ($p < 0.001$).

Conclusions: Malignant otitis externa is a rare disease, which is best managed in a multidisciplinary team setting. This practical grading system can be used to predict the duration of therapy at time of diagnosis, which enables the efficient utilisation of Hospital resources. Poorly controlled diabetics are more susceptible to developing.

MOE than diabetics with satisfactory glycaemic control and may represent a subgroup of more brittle diabetics. CRP combined with appropriate clinical and radiological investigations is useful in assessing disease resolution.

Grading System

Table 1 – Radiological grading criteria utilised in this study.

Grade	Diagnostic criteria
I	Disease limited to soft tissue and not involving bone, refractory to standard antibiotic therapy for >1 week
II	Earliest form of MOE with bone involvement limited to the mastoid
III	MOE extending medially to involve the petrous temporal bone
IV	MOE extending medially to involve the petrous apex or with cranial nerve involvement or pread anteriorly to involve the facial bones, posteriorly to involve the occipital bone, or spread to the contralateral base of skull

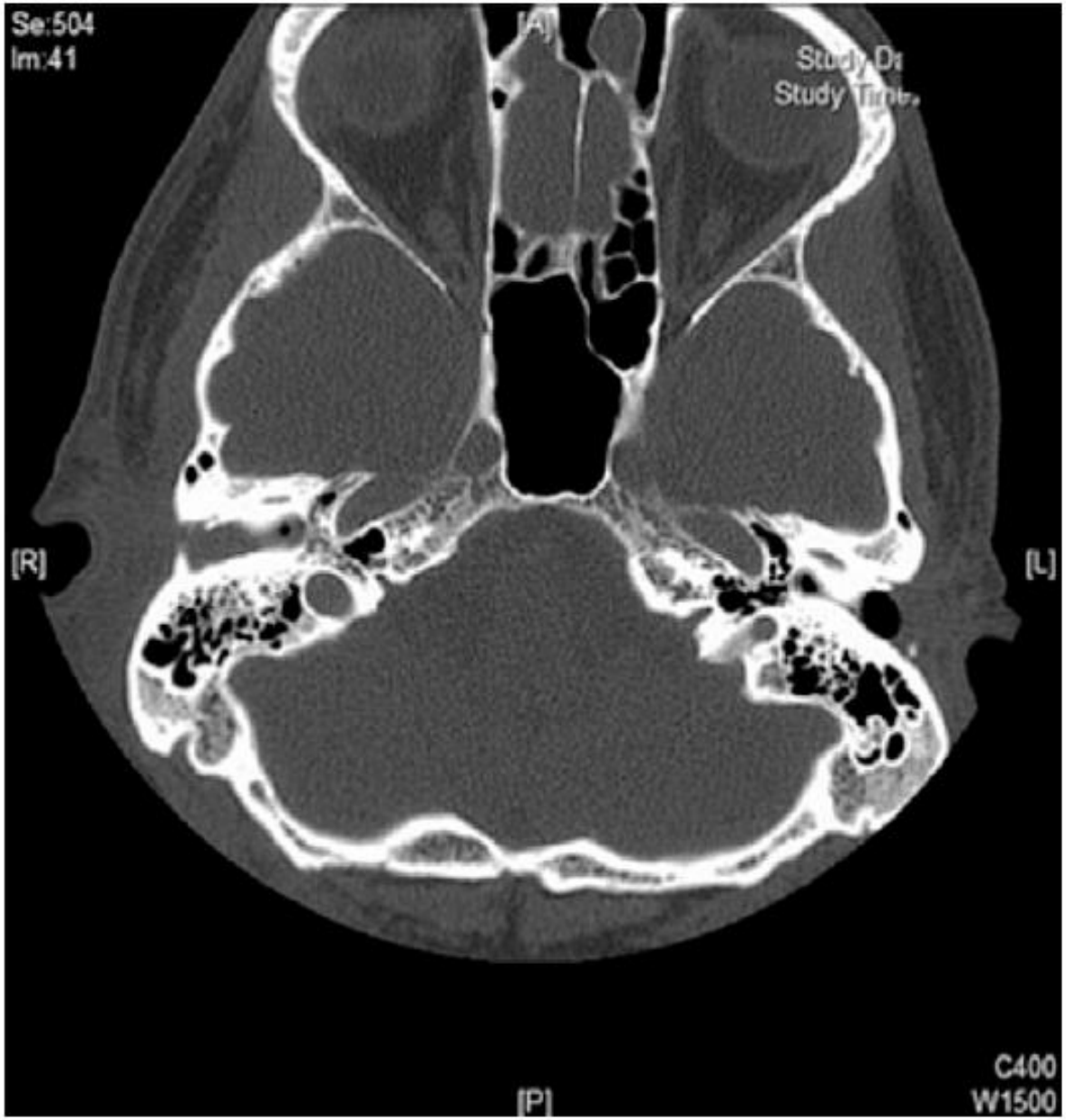

Fig. 1 – CT Scan of Grade I disease with soft tissue disease of the right external canal.

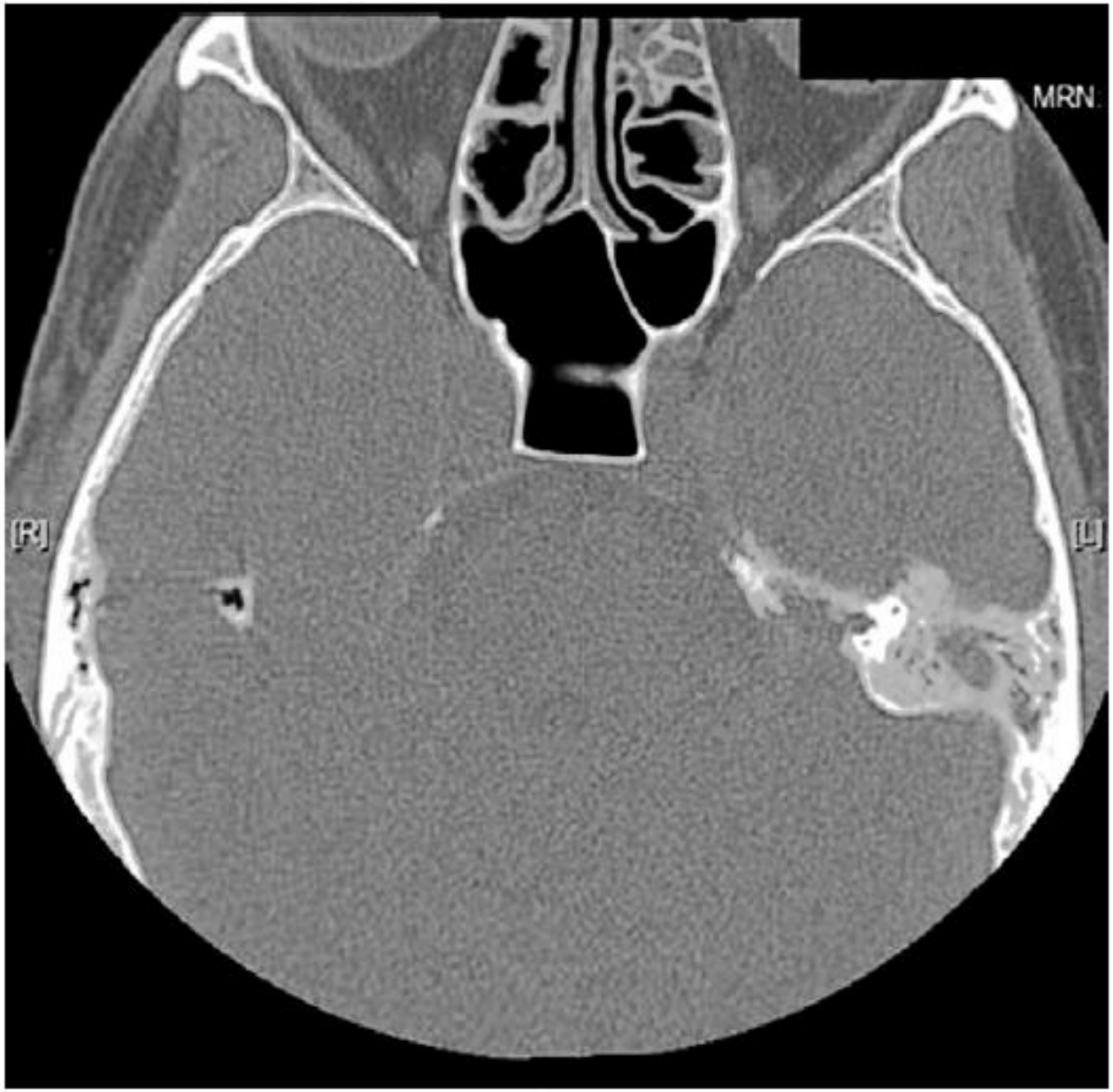

Fig. 2 – CT Scan of Grade II disease involving the right mastoid process.

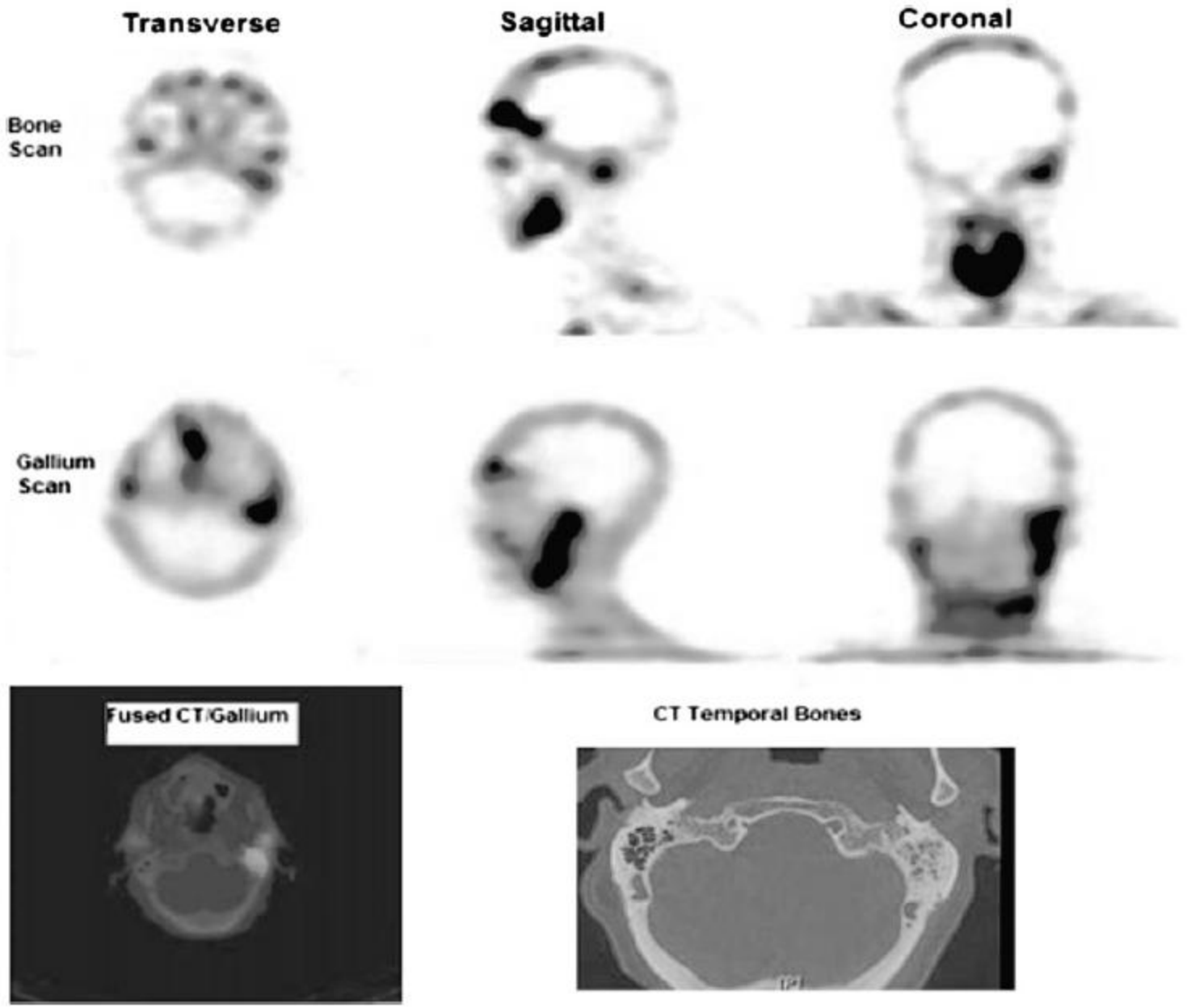

Fig. 3 – CT, SPECT and gallium scan of stage III disease involving the mid-portion of the petrous pyramid

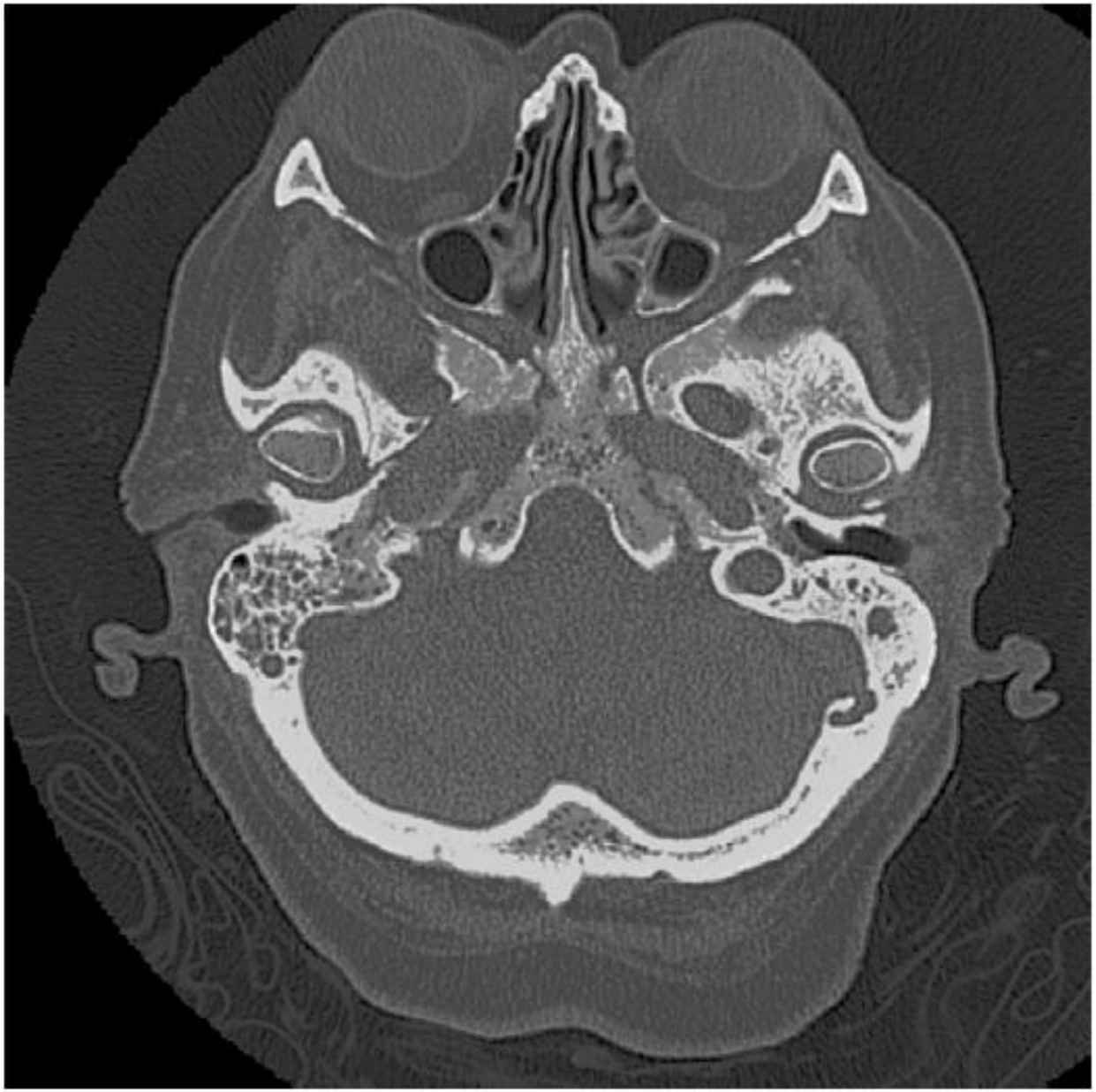

Fig. 4 – CT Scan of Grade IV disease involving the whole petrous temporal bone.

Patients were grouped by duration of treatment required to achieve complete disease resolution: 7/23 (30%) required < 3 months, 14/23 (61%) required 3–6 months, and 2/23 (9%) required > 6 months of treatment.

Duration of therapy was significantly associated with Grade (rank correlation 0.57, $p = 0.004$). Antibiotic therapy was guided by clinical findings and culture results. A summary of the antimicrobials used is highlighted in Table 3.

Multiple organisms were grown in 9/24 (38%) patients, 1/24 (4%) patients had no growth and 1/24 (4%) grew mixed skin flora. Fungi were grown in 7/24 (29%) of patients but only 2 of these were true fungal MOE (Monoculture of Fungus). 1

Table 4 – Breakdown of organisms cultured – some patients grew more than one organism.

Organism	Number of patients
P. aeruginosa	15/24 (62%)
Serratia	2/24 (8%)
S. pneumonia	1/24 (4%)
Corynebacterium	1/24 (4%)
S. aureus	4/24 (2%)
Yeast	3/24 (13%)
Candida	1/24 (4%)
Aspergillus fumigatus	3/24 (13%)
Aspergillus niger	1/24 (4%)
Mixed Skin Flora	1/24 (4%)
No Growth	1/24 (4%)

most commonly affecting the facial nerve and more rarely a combination of nerves (VI, VII, IX, X, XI, XII).[6] Cranial nerve involvement does not appear to be associated with a worsening of prognosis but full recovery of function, such as facial nerve function, may be slow or incomplete.[7]

One patient had a synchronous squamous cell carcinoma in the presence of active skull base osteomyelitis and underwent surgical resection, antimicrobial therapy and adjuvant radiotherapy.

Biopsy is of critical importance in aiding diagnosis of synchronous lesions, as imaging modalities may not be able to distinguish between active infection and the presence of a neoplastic process, and the clinical picture may be quite similar in both conditions.[9,10]

Research Article

Temporal Bone Osteomyelitis: The Relationship with Malignant Otitis Externa, the Diagnostic Dilemma, and Changing Trends

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to MOE [5]. The most commonly causative organism is *Pseudomonas aeruginosa*, although other organisms such as *Proteus mirabilis*, *Aspergillus fumigatus*, *Proteus* sp., *Klebsiella* sp., and *staphylococci* have been isolated

spread of infection into the temporal bone occurs through the fissures of Santorini and the tympanomastoid suture, leading to involvement of the stylomastoid and jugular foramina and eventually affecting cranial nerve function. The diagnosis of osteomyelitis of the temporal bone is based on a combination of clinical findings, a laboratory test, radiographic examination, and nuclear imaging. In 1987, Cohen and Friedman

Taipei Veterans General Hospital, from January 1990 to December 2011. The criteria on which the diagnosis of osteomyelitis of the temporal bone was based included (1) clinical symptoms of persistent otalgia or otorrhea; (2) failure to respond to medical therapy and local treatment; (3) uptake at the temporal bone on bone scan and gallium scan; (4) exclusion of ear tumor by histopathology if granulation tissue was present; and (5) positive findings on computed tomography (CT) or magnetic resonance imaging (MRI). These patients were divided to two groups. Patients who were collected from 1990 to 2001 were group 1 and those from 2002 to 2011 were group 2. The patients' characteristics of the

During the study period, a total of 55 patients with the diagnosis of osteomyelitis of the temporal bone were treated at our institution. Group 1 included 20 patients with the remaining 35 patients assigned to group 2. Group 2 was further divided into group 2-only patients without previous ear operation and group 2-only patients with previous ear operation. Among group 1, there were 13-male and 7-female

TABLE 1: Comparison among group 1, group 2, group 2-only patients without previous operation (group 2 without op), and group 2-only patients with previous operation (group 2 with op

	Group 1 (n = 20)	Group 2 (n = 35)	Group 2 without op (n = 20)	Group 2 with op (n = 15)	Significance			
					Group 1 versus group 2	Group 1 versus group 2 without op	Group 1 versus group 2 with op	Group 2 without op versus group 2 with op
Clinical features								
Age (mean ± SD), years	64.3 ± 9.9	66.8 ± 15.0	71.8 ± 12.7	60.1 ± 15.7	0.454	**0.044**	0.351	**0.021**
Gender (M/F)	13/7	21/14	15/5	6/9	0.779	0.731	0.182	0.080
Diabetes	19 (95.0%)	16 (45.7%)	12 (60.0%)	4 (26.7%)	**<0.001**	**0.020**	**<0.001**	0.087
Previous surgery	0 (0%)	15 (42.9%)	0 (0%)	15 (100%)	**<0.001**	—	—	—
Otalgia (pain)	19 (95.0%)	22 (62.9%)	19 (95.0%)	3 (20%)	**0.010**	1.000	**<0.001**	**<0.001**
Otorrhea (exudate)	18 (90%)	30 (85.7%)	16 (80.0%)	14 (93.3%)	1.000	0.661	1.000	0.365
Otitis externa (swelling)	20 (100%)	16 (45.7%)	14 (70.0%)	2 (13.3%)	**<0.001**	**0.020**	**<0.001**	0.069
Granulation over EAC	16 (80%)	11 (31.4%)	9 (45.0%)	2 (13.3%)	**0.001**	**0.048**	**<0.001**	**0.002**
CN involvement	4 (20%)	5 (14.3%)	5 (25.0%)	1 (6.7%)	0.709	1.000	0.680	0.672
Microbiology								
P. aeruginosa	11 (55%)	9 (25.7%)	9 (45.0%)	0 (0%)	**0.043**	0.752	**0.001**	**0.004**
MRSA	5 (25%)	14 (40.0%)	7 (35.0%)	7 (46.7%)	0.378	0.731	0.282	0.511
Negative culture	2 (10%)	3 (8.6%)	1 (5.0%)	2 (13.3%)	1.000	1.000	1.000	0.565

Bold type denotes statistically significant difference ($P < 0.05$).

Table 2: Comparison among patients with *P. aeruginosa* infection, non-*P. aeruginosa* infection, non-*P. aeruginosa* infection-only patients without previous ear operation (non-*P. aerugi* nfection without op), and non-*P. aeruginosa* infection-only patients with previous ear operation (non-*P. aeruginosa* infection with op).

	P. aeruginosa ($n = 20$)	Non-*P. aeruginosa* ($n = 35$)	Non-*P. aeruginosa* without op ($n = 20$)	Non-*P. aeruginosa* with op ($n = 15$)	Significance: *P. aeruginosa* versus non-*P. aeruginosa*	*P. aeruginosa* versus non-*P. aeruginosa* without op	*P. aeruginosa* versus non-*P. aeruginosa* with op	Non-*P. aeruginosa* without op versus non-*P. aeruginosa* with op
Clinical features								
Age (mean ± SD), years	65.8 ± 13.1	65.9 ± 13.7	70.3 ± 10.5	60.1 ± 15.7	0.976	0.242	0.252	**0.029**
Gender (M/F)	13/7	21/14	15/5	6/9	0.779	0.731	0.182	0.080
Diabetes	16 (80%)	19 (54.3%)	15 (75%)	4 (26.7%)	0.082	1.000	**0.002**	**0.007**
Previous surgery	0 (0%)	15 (42.9%)	0 (0%)	15 (100%)	**<0.001**	—	—	—
Otalgia (pain)	20 (100%)	21 (60.0%)	18 (90%)	3 (20%)	**0.001**	0.487	**<0.001**	**<0.001**
Otorrhea (exudate)	20 (100%)	28 (80.0%)	14 (70%)	14 (93.3%)	**0.04**	**0.020**	0.429	0.199
Otitis externa (swelling)	17 (85%)	19 (54.3%)	17 (85%)	2 (13.3%)	**0.038**	1.000	**<0.001**	**<0.001**
Granulation over EAC	13 (65%)	14 (40.0%)	12 (60%)	2 (13.3%)	0.097	1.000	**0.005**	**0.007**
CN involvement	3 (15%)	5 (14.3%)	4 (20%)	1 (6.7%)	1.000	1.000	0.619	0.365

Bold type denotes statistically significant difference ($P < 0.05$).

TABLE 3: Patient characteristics between patients with and without history of previous otologic surgery.

	Previous surgery (n = 15)	No previous surgery (n = 40)	Significance
Clinical features			
Age (mean ± SD), years	60.1 ± 15.7	68.0 ± 11.9	$P = 0.05$
Gender (M/F)	6/9	28/12	$P = 0.062$
Diabetes	4 (26.7%)	31 (77.5%)	$P = 0.001$
Otalgia (pain)	3 (20%)	38 (95.0%)	$P < 0.001$
Otorrhea (exudate)	14 (93.3%)	34 (85.0%)	NS
Otitis externa (swelling)	2 (13.3%)	34 (85.0%)	$P < 0.001$
Granulation over EAC	2 (13.3%)	25 (62.5%)	$P = 0.002$
CN involvement	1 (6.7%)	7 (17.5%)	NS
Microbiology			
Pseudomonas aeruginosa	0 (0%)	20 (50.0%)	$P < 0.001$
MRSA	7 (46.7%)	12 (30.0%)	NS
NTM	3 (20%)	1 (2.5%)	$P = 0.057$
Negative	2 (13.3%)	3 (7.5%)	NS

must keep in mind that osteomyelitis of the temporal bone should be considered in nondiabetic and older patients. For

In this series, leukocytosis was not a good diagnostic tool because only 0%–11.1% of patients of all these groups had

(ESR and CRP) may be a useful laboratory test for temporal bone osteomyelitis. An elevated erythrocyte sedimentation rate (ESR) was identified as a useful tool in screening for this illness and monitoring response to therapy [5, 13].

Tc99m scan and gallium scan, is considered as a useful tool for initial diagnosis of osteomyelitis of the temporal bone. Tc99m scan is exquisitely sensitive because the radiotracer accumulates at sites of osteoblastic activity but is relatively nonspecific [14] and also remains positive until cessation of osteoblastic activity that persists long after the infection has been eradicated. Thus, it had limited role when assessing the

In contrast, gallium citrate is absorbed by macrophages and reticular endothelial cells and concentrates in areas of active inflammation, including soft tissue and bone infections. Gallium scans quickly return to normal after the infection has settled and can be used for radiological assessment of the response to therapy [7]. Gallium scan is more specific to acute infection, and its SPECT technique can be used

practice, patients with positive Tc99m and negative gallium results usually turned out to have limited mastoiditis or post-operative changes such as mastoidectomy cavity infection, not osteomyelitis of the temporal bone. On the other hand,

the clinical courses of patients with positive gallium scans and Tc99m scans generally indicate inflammation of the temporal bone. Accordingly, our results suggest that both gallium and Tc99m scans should be performed earlier in patients with high suspicion because the clinical manifestations of osteomyelitis of the temporal bone have become less typical and noticeable than before.

Thank you for your attention!