



CHAPTER VI

RESULTS

6.1 Detection of activation focus

The two major results of SPM analysis issue are the precise anatomic location of a specific activation and the number of voxels (k_c) in activation focus.

In this study a fixed p-value = 0.001 (uncorrected for whole brain) was used for all sizes and sites of lesion in the brain phantom. The ratios between lesion counts and brain soft tissues counts (bg.) were fixed between 1.4 and 2.6 as shown in table 6.1-6.3. The reconstructed images from SPECT are shown in figure 6.1, 6.3, 6.5, 6.7, 6.9, 6.11 and the lesions detected by SPM are shown by projecting on the glass brain as shown in figure 6.2, 6.4, 6.6, 6.8, 6.10. The summary of results is presented as the following.

Table 6. 1: The SPM visualization of lesion of various sizes in brain phantom at anterior cortex.

Lesion size (mm)	Lesion : bg ratio	Visualization by SPM	p-value(uncorrected for whole brain)
4	1.4	None	p=0.001
9	2.4	Cluster	p=0.001
14	2.6	Cluster	p=0.001

Table 6. 2: The SPM visualization of lesion of various sizes in brain phantom at posterior cortex.

Lesion size (mm)	Lesion : bg ratio	Visualization by SPM	p-value(uncorrected for whole brain)
4	1.4	None	p=0.001
9	1.7	None	p=0.001
14	1.8	Cluster	p=0.001

Table 6.3: The SPM visualization of lesion of various sizes in brain phantom at basal ganglia.

Lesion size (mm)	Lesion : bg ratio	Visualization by SPM	p-value(uncorrected for whole brain)
4	2.4	Cluster	p=0.001
9	2.2	Cluster	p=0.001
14	1.8	Cluster	p=0.001

6.1.1 Lesion size 14 mm fixed at anterior and posterior cingulate cortex.

Reconstructed brain image by SPECT with 2 lesions(size 14 mm) placed in anterior and posterior cingulate cortex on condition of ictal and interictal states are shown in figure 6.1. All lesions could be visualized.



Figure 6.1: Reconstructed brain image with lesion size 14 mm at anterior and posterior cingulate cortex by SPECT

By SPM program the activation focus was detected, number of voxel present (k_c) was 1144 (anterior) and 1052 (posterior). (figure6.2)

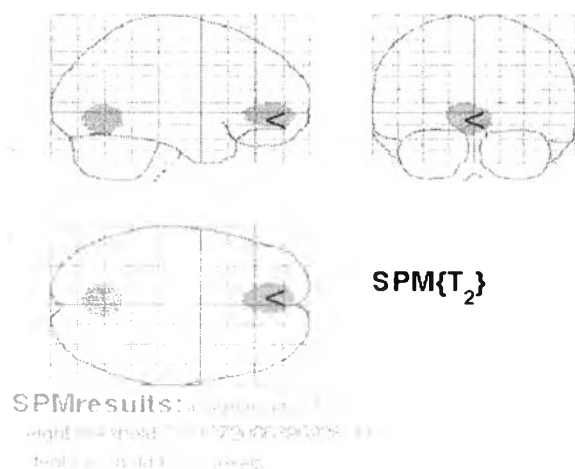


Figure 6.2 : Detection of activation focus of brain phantom with lesion size 14 mm at anterior and posterior cingulate cortex by SPM

6.1.2 Lesion size 14 mm fixed at basal ganglia

Reconstructed image with lesion size 14 mm at basal ganglia could be visualized as in figure 6.3



Figure 6.3 : Reconstructed brain image with lesion size 14mm by SPECT

By SPM program the activation focus could be visualized obviously. Number of voxel present (k_e) was 978. (figure 6.4)

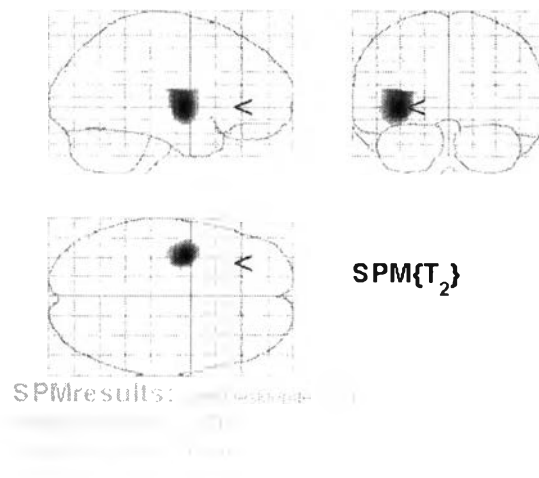


Figure 6.4 Detection of activation focus of brain phantom with lesion size 14 mm at basal ganglia by SPM

6.1.3 Lesion size 9 mm fixed at anterior and posterior cingulate cortex

Reconstructed brain phantom with lesions size 9 mm fixed at anterior and posterior cingulate cortex could be visualized by SPECT as in figure 6.5. The data was transferred by SPM program which the activation focus could be seen in anterior cingulate cortex, but it was not visualized in posterior cingulate cortex. Number of voxel presents (k_c) was 368.

(figure 6.6)



Figure 6.5 : Reconstructed brain image with lesion size 9 mm at anterior and posterior cingulate cortex by SPECT

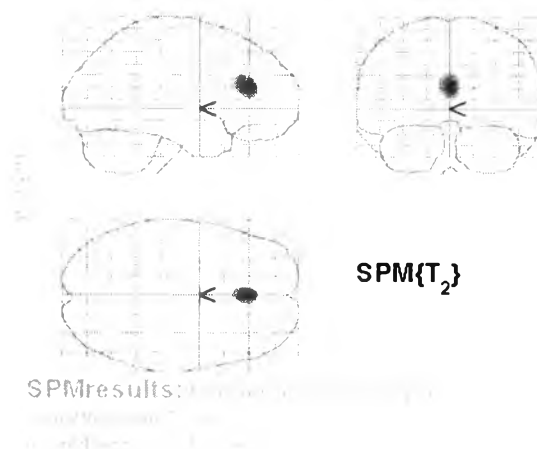


Figure 6.6 : Detection of activation focus of brain phantom with lesion size 9 mm at anterior cingulate cortex by SPM

6.1.4 Lesion size 9 mm fixed at basal ganglia

Lesion could be visualized by SPECT as in figure 6.7, but not clearly by SPM program (figure 6.8). The activation focus showed some significant voxels in the basal ganglia region, number of voxel (k_p) present was 314



Figure 6.7 : Reconstructed image with lesion size 9mm at basal ganglia by SPECT

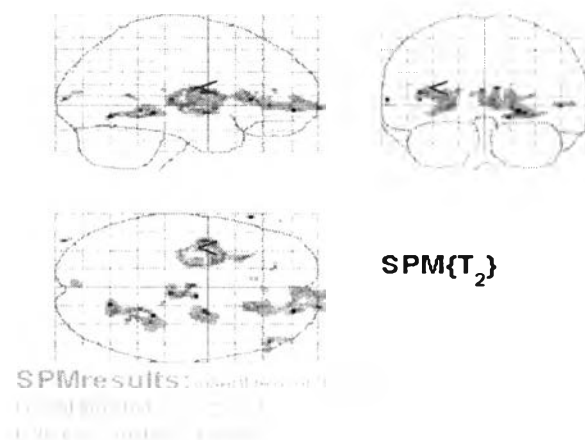


Figure 6.8 : Detection of activation focus of brain phantom with lesion size 9 mm at basal ganglia by SPM

6.1.5 Lesion size 4 mm fixed at anterior and posterior cingulate cortex

Reconstructed image with two lesions size 4 mm each at anterior and posterior cortex could be visualized by SPECT (figure 6.9), but could not be visualized by SPM program (figure6.10)



ictal image



interictal image

Figure 6.9 : Reconstructed brain image with lesion size 4 mm at anterior and posterior cingulate cortex by SPECT

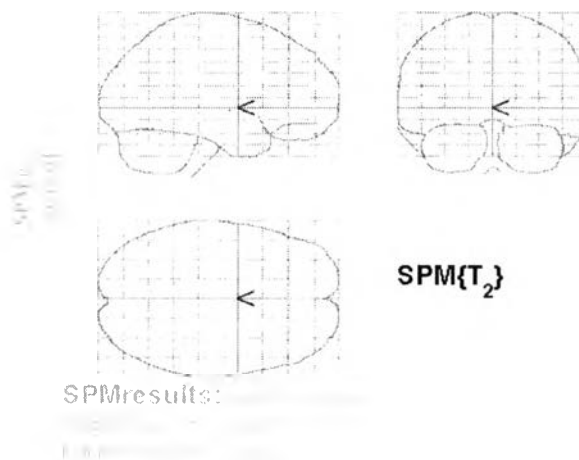


Figure 6.10 : Detection of activation focus of brain phantom with lesion size 4 mm at anterior and posterior cingulate cortex by SPM- not visualized

6.1.6 Lesion size 4 mm fixed at basal ganglia

Reconstructed brain image with lesion size 4 mm at basal ganglia could be visualized by SPECT (figure 6.11) and also visualized in SPM analysis part (figure 6.12)

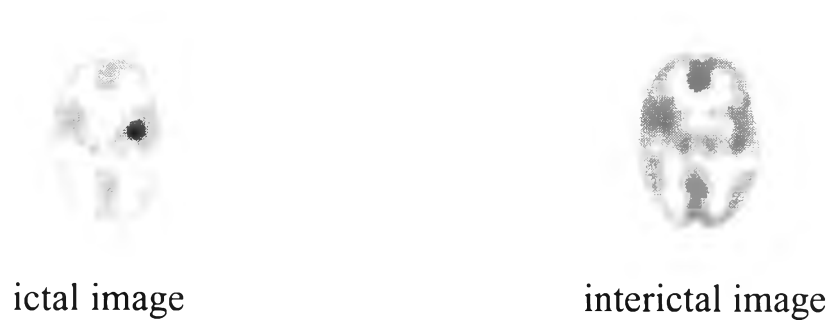


Figure 6.11 : Reconstructed brain image with lesion size 4 mm at basal ganglia by SPECT

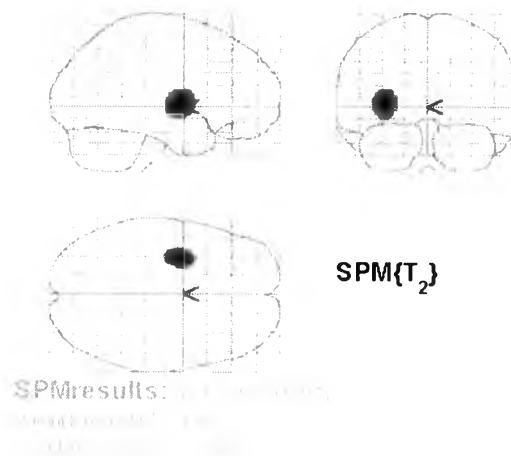


Figure 6.12 : Detection of activation focus of brain phantom with lesion size 4 mm at basal ganglia by SPM

For the lesions not detected by SPM (4mm. at anterior and posterior, 9 mm at posterior), varying threshold was attempted first. There was no lesions detected by varying the threshold. Afterward varying the lesion:background ratio were tried ranging from 2.1-2.5. These could not generate the lesions visualization by SPM as well.

Number of voxels (k_e) detected by SPM program for each size were calculated to transfer to term of the volume detected by SPM ($k_e * \text{voxelsize}_x * \text{voxelsize}_y * \text{voxelsize}_z$) and compare it against the true volume of artificial lesions ($V = \pi r^2 h$). The comparison between two volumes are in the following tables.(Table6. 4, table6. 6, table6.7)

Table 6.4 : The volume of the brain lesion size 14 mm determined by SPM compared to the actual volume at different sites.

Site	No.of voxel (k_e)	SPM volume(mm^3) [(k_e). 2x2x2]	True volume(mm^3) ($\pi r^2 h$)	Volume ratio (SPM : True)
Anterior cortex	1144	9152	1077	8.4
Posterior cortex	1052	8416	1077	7.8
Basal ganglia	978	7896	1077	7.2

Table 6.5 : The volume of the brain lesion size 9 mm determined by SPM compared to the actual volume at different sites.

Site	No.of voxel (k_e)	SPM volume(mm^3) [[k_e]. 2x2x2]	True volume(mm^3) ($\pi r^2 h$)	Volume ratio (SPM : True)
Anterior cortex	368	2944	317	9.2
Posterior cortex	None	None	317	-
Basal ganglia	314	2512	317	7.9

Table 6.6 : The volume of the brain lesion size 4 mm determined by SPM compared to the actual volume at different sites.

Site	No.of voxel (k_e)	SPM volume(mm^3) [[k_e]. 2x2x2]	True volume(mm^3) ($\pi r^2 h$)	Volume ratio (SPM : True)
Anterior cortex	None	None	62.8	-
Posterior cortex	None	None	62.8	-
Basal ganglia	110	880	62.8	14.0