Optimal Localization and Image Fusion
for DSA/MRI/CT using Leksell Frame

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INTORDUCTION

Correct Localization for stereotactic radiosurgery is very important for patient in treatme
nt process, because radiation of the X-ray beam have an injurious action on other critical
organ, not target tumor. But the images of DSA/MR/CT which contain correct location
of the tumor are independent of one another, and usually three images have a little distor
tion, particularly the image of MR is seriously distorted. So the correction of the distorti
on is needed to find the correct location of the tumor. I.G, the purpose of this study is t
o obtain the correction of three independent image location through revising distortion of
images and image fusion.

METHOD

In order to obtain the correct location of the object, Leksell frame localizers of the DSA/
MRI/CT were fixed to the phantom, having ten target ball (lead). moreover, to correct di
stortion of the images, the grid phantom, was made ,which consist of channel $3mm^2$ in c
ross section, is arranged as a rectangular grid with 10mm spacings, is filled by 10mM co
pper sulfate solution.. We have developed algorithm to obtain correct location of the tum
or and to correct distortion. Coordinates calculated by algorithm is compared with absolut
e coordinates of the phantom, other images of MRI/CT were fused into DSA image whic
h is distorted less than other images.

RESULT

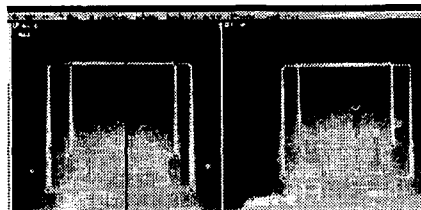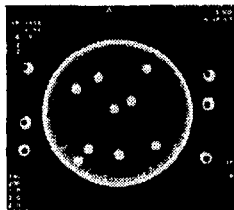A little error is estimated, comparing the location obtained by the program with real loc
ation

The errors of DSA : 0.41±0.05mm

The errors of CT : 1.02±0.17mm (512×512 matrix, 2mm slice)

The errors of MRI : anterior : -0.65±0.95mm(240mm FOV, 512×512 matrix 2mm slice)

Lateral : 0.54±1.28mm

Posterior : -1.32±3.15mm

(CT/MRI Fusion)　　　　　　　　　(DSA/MRI/CT Fusion)
White : MRI point　　　　　　　　Red Line : Each contour of CT Image
Gray : CT Point

DISCUSSION

The errors is made in the course of taking image by three devices. and in finding locati on by the program. Exactly these causes are below.- Changing of fixed location of the lo calizer of appliances of DSA/MRI/CT. Distortion in taking images along devices feature, scanning distortion of image. Incorrectly checking tumor location in using computer applia nces (mouse. Etc..), Pixel size along the monitor size setup.- Especially MRI distortion(ve ry serious) is corrected by algorithm. Over errors of the tumor location is permissible, w hen comparing formal time research (DSA:0.90±0.40, CT : in 2mm slice,0.91±0.30, in 4m m slice, 1.58±0.05mm, MRI : compare with CT)

CONCULSION

The location of the tumor by three imaging process are not matched exactly. But through processing correction of distortion of MRI and CT , the errors are within the degrees of permission. This results improve the success probability of the radiosurgery, is applied to robotics surgery in the stereotactic radiosurgery, researching structure of the organs, telet herapy among long distant hospitals.