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S

가

1951 Leksell (1,2), 1957 Talairach (3) 가 (6-9).

3 가 (conventional angiography, cut film)

(digital subtraction angiography) (computed tomography), (magnetic resonance imaging) 가 (4,5).

(PACS : picture achieving and communication system)

3

가 가 가 (10-11),

<sup>1</sup> 가

<sup>2</sup> 가 (11).

가

가

가 15cm, 15cm, 1cm 2cm  
1mm (iron ball) 64 (8×8 ) G-  
(Fig.1). 38cm

20cm  
(Integris V3000, Version 4, Philips.Netherlands)

2 15cm

15cm

45.8cm

(Scanjet 4c/T,  
Hewlett Packard, California, U.S.A.) TIF file  
(UTHSCSA ImageTool for Windows ,  
version 2.00, University of Texas Health Science Center in San  
Antonio, Copyright 95-96, U.S.A.)

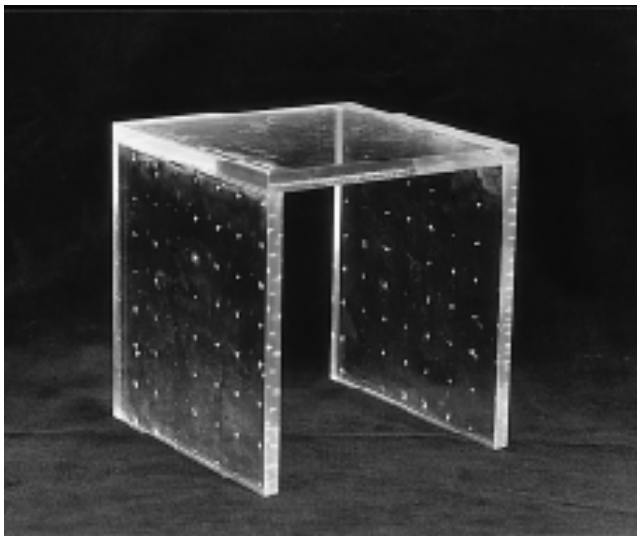


Fig. 1. The phantom designed for digital subtraction angiography.

(Fig. 2).

가

가 , 가

가 , 가

2

가

2

paired student t-test

(Fig. 2).

4

0cm 15cm

15cm ,

38cm ( ),

A,

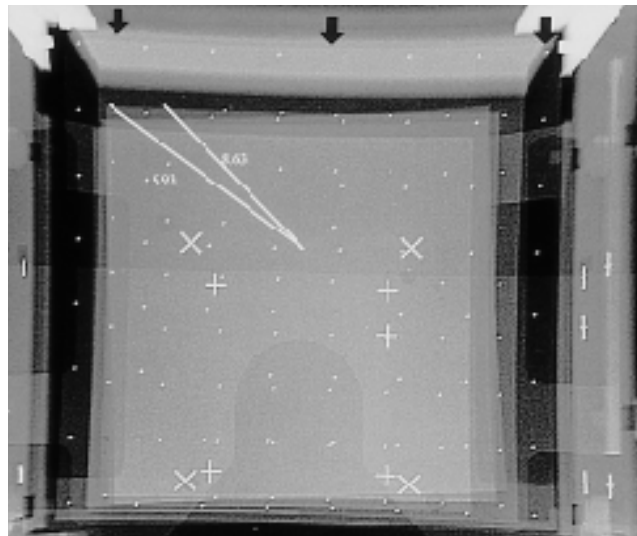
B, A 15cm 20cm (

) C , C 15cm

D

Table 1

가



**Fig. 2. Distance measurement of the phantom. Note the pin-cushion distortion of the inferior layer of the markers on the phantom (arrows).**

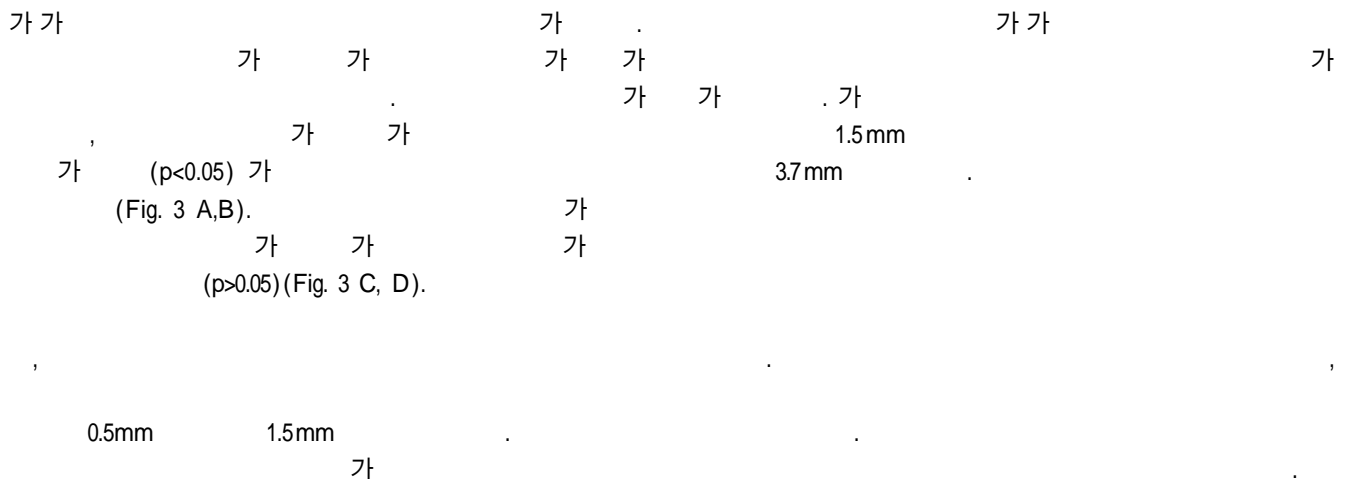


Table 1. Errors in DSA Phantom Study

	Condition of DSA			
	A	B	C	D
Intensifying tube size (cm)	38	38	20	20
Distance (cm) between tube and object	0	15	0	15
Number of marker ball	48	48	44	22
Absolute mean (mm)	1.07	0.60	0.79	0.49
Maximum (mm)	3.68	3.46	2.50	1.44
Standard deviation (mm)	0.85	0.61	0.59	0.35

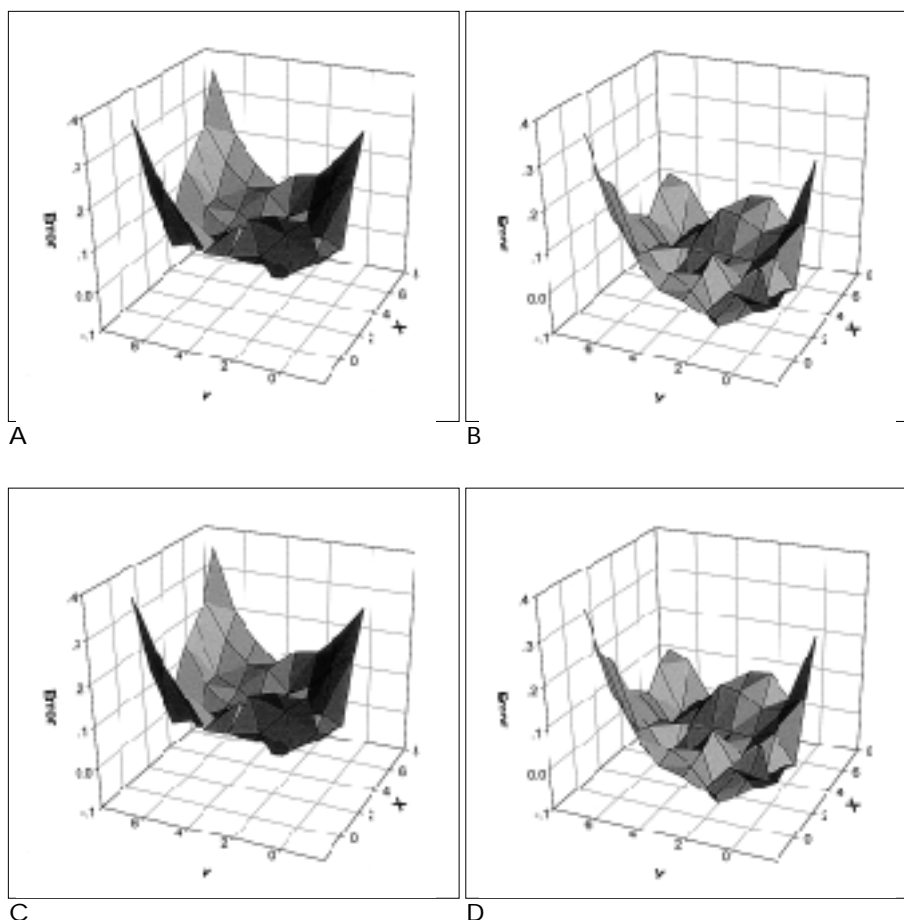


Fig. 3. Errors in each DSA phantom study.

A. In the condition that the distance between the tube and phantom is 0cm and large image intensifier is used, the distortion of peripheral portion of the image is marked.

B. In the condition of 15cm distance between the tube and phantom and large image intensifier, the distortion of peripheral portion is still prominent but slightly milder than that of A.

C. In the condition of distance 0cm and small image intensifier, the peripheral distortion becomes flattened.

D. In the condition of distance 15cm and small image intensifier, peripheral distortion becomes more flattened.

가 .

가 .

가 가 38cm

15cm

2 , 3 가 , 가

가 .

가 (A: ; 0cm. ; 38cm) 3.68mm

가 (D: ; 15cm, 1.44mm 가 ; 20cm)

가 .

가 .

가 1.5mm

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## **Assessment of Spatial Distortion in Digital Subtraction Angiography for Stereotactic Radiosurgery: An Experimental Study with Phantom<sup>1</sup>**

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**Purpose:** In stereotactic radiosurgery, awareness of the precise localization and volumetry of tumors and of critical organs, and the planning of the treatment field are important. The purpose of this study was to determine the degree of distortion in images obtained by digital subtraction angiography(DSA) and to assess whether DSA is a suitable may substitute for MRI in the planning of stereotactic radiosurgery.

**Materials and Methods:** After designing DSA phantoms we obtained images under variable conditions and analyzed image distortion using an image analysis program.

**Results:** DSA imaging distortion increased as intensifying tube size became greater and the distance between tube and object decreased.

**Conclusion:** Images obtained by DSA imaging were very distorted, and in the planning of stereotactic radiosurgery DSA is not, therefore, a suitable substitute for MRI.

**Index words :** Digital subtraction angiography  
Digital subtraction angiography, technology  
Stereotaxis

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