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Research Paper

Efficacy of Automated Scan Planning for Brain Using AutoPose with 1.5T MRI System ECHELON

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Automated Scan Planning for Brain Using AutoPose was newly introduced with upgrade of 1.5T MRI System ECHELON* in our hospital. AutoPose is use usual Positioning picture 3 sections. It is possible to perform slice positioning,without making inspection time extend. We verified the usefulness and reproducibility, is reported.

Key Words: AutoPose, Scan Planning, MRI, ECHELON

1. Introduction

The 1.5T MRI system ECHELON* (Figure 1) owned by our hospital was given a new function, AutoPose, Automated Scan Planning for Brain by the upgrade to V4.0A released on February 26, 2012.
In the past, an automated scan planning function was reported to improve the operability of an MRI system, and, for the brain, 3D images were commonly used as scanograms[1)]. Although this previous method using 3D images had high accuracy, acquisition of scanograms was time-consuming. The AutoPose automated scan planning function that has been introduced to our hospital this time uses three sections of scanograms to perform slice positioning without extending the examination time.

Fig.1 External view of ECHELON

2. Background and Objectives

When brain MRI is performed on the same patient under clinical follow-up, the reproducibility of imaging ranges is important. However, imaging by different operators is considered to be one of the causes of lowering the reproducibility. Additionally, staffs inexperienced in MRI operations have difficulty conducting accurate scan planning so that a low reproducibility of imaging ranges is expected.
Since the AutoPose automated scan planning function is considered to be effective in solving these problems, we examined the accuracy of this function as reported herein.

3. Overview of AutoPose

AutoPose calculates the midline position using AX and COR of a 2D scanogram and creates a median plane image using the inclination of the midline position and SAG of the scanogram. Then, it extracts anatomical features from the obtained median plane image and identifies an imaging position that meets the criteria specified in the output position setting screen (Figure 2) in advance. Since this course of processing is started immediately after acquisition of a 2D scanogram and executed in the background of other processing (about two seconds), AutoPose provides support in scan planning operation without extending the conventional examination flow and reduces the number of operations.

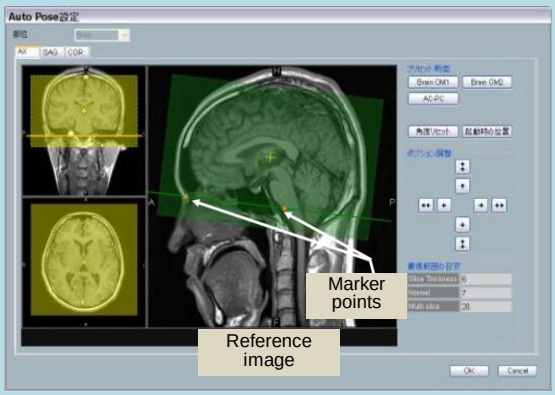


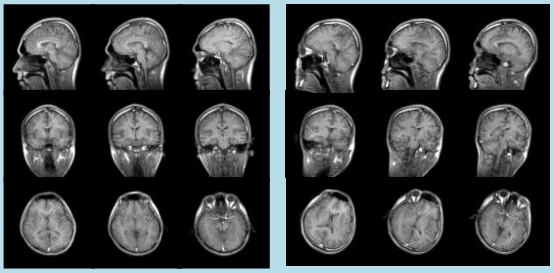
Fig.2 Output position setting screen

4. Experiment Method

AutoPose was used to perform imaging of the brains of healthy volunteers approved by the institution.

(1) Evaluation of reproducibility
Imaging was performed in the normal position and four irregular positions with the brain position randomly changed in the application range of AutoPose. The reproducibility was examined using the obtained imaging cross-sections.

(2) Evaluation of workflow
In the normal and irregular positions (Figure 3), operators experienced and inexperienced in MRI performed the usual manual scan planning and automated scan planning using AutoPose. The time required from loading of a scanogram to start of imaging was measured for each of the operators and compared.



a XY: 0 deg., XZ: 0 deg., YZ: 0 deg.

b XY: 17.38 deg., XZ: 14.72 deg., and YZ: 17.01 deg

Fig.3 Normal position (a) and irregular position (b)

(3) Evaluation using clinical examples
Using clinical examples, the cases in which AutoPose could be applied and could not be applied were examined.

5. Results and Discussion

The reproducibility evaluation (Figure 4) found that the reproducibility of imaging cross-sections had an exceedingly high accuracy, and therefore the algorithm of AutoPose, particularly the technology of matching sagittal image template data seems to be taking effect. The workflow evaluation (Figure 5) compared the cases in which AutoPose was used and not used in the irregular positions and found that the required time was shortened by an average of 15.1 seconds for experienced operators and an average of 47.1 seconds for inexperienced operators.

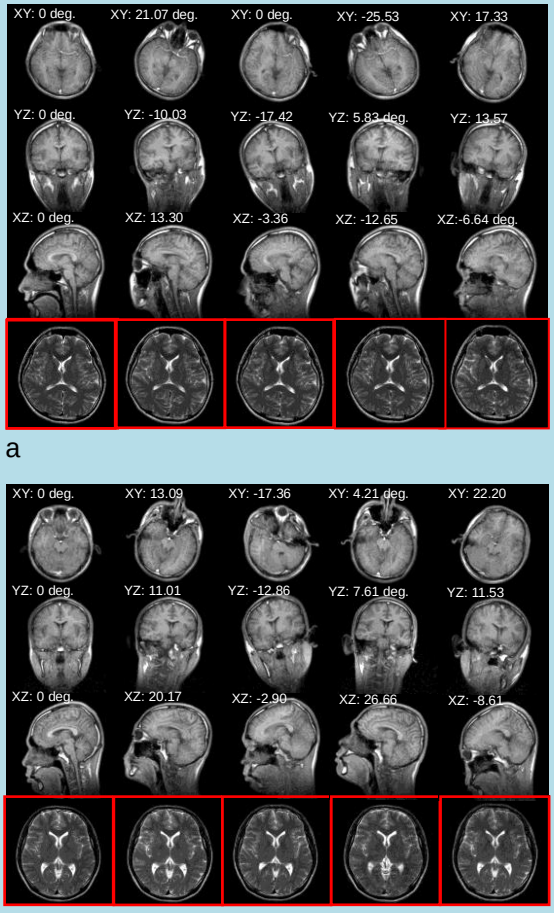


Fig.4 Position angles and imaging cross-sections of Volunteers 1 (a) and 2 (b)

The evaluation using clinical examples (Figure 6) found that, since positional correction is calculated from the morphologies of midline and obtained sagittal images, malfunction or misrecognition may occur for significantly different anatomical structures due to tumors, etc.

	Position	AutoPose	max	min	average	Average shortened time
Experienced operators N=11	Normal	No	25.3	15.3	19.2	7.2
		Yes	15.7	6.8	12.1	
	Irregular	No	44.5	23.8	30.1	15.1
		Yes	25.1	9.7	15.0	
Inexperienced operators N=5	Normal	No	55.8	28.0	42.0	26.9
		Yes	20.6	9.9	15.0	
	Irregular	No	101.5	42.3	63.1	47.1
		Yes	23.7	9.3	16.0	

Fig.5 Time required from loading of scanogram to pressing of imaging start button (seconds)

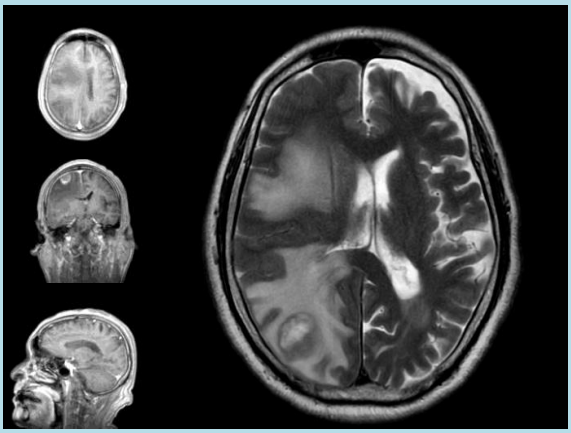
6. Conclusion

The slice positioning in imaging using AutoPose has an exceedingly high reproducibility. Accurate positioning with a good reproducibility can be expected even with irregular postures that are encountered daily or in operation by different operators or staff inexperienced in MRI operation. Additionally, the shortening of examination workflow was demonstrated both for experienced and inexperienced operators. However, normal positioning may not be executed in cases with widespread lesions, and therefore the applicability of AutoPose must be identified.

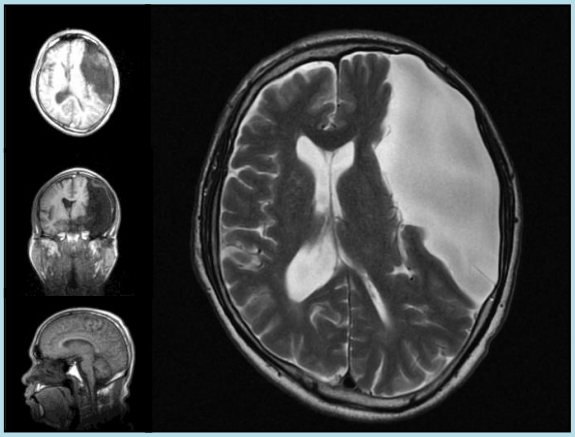
* ECHELON is a registered trademark of Hitachi Medical Corporation.

References

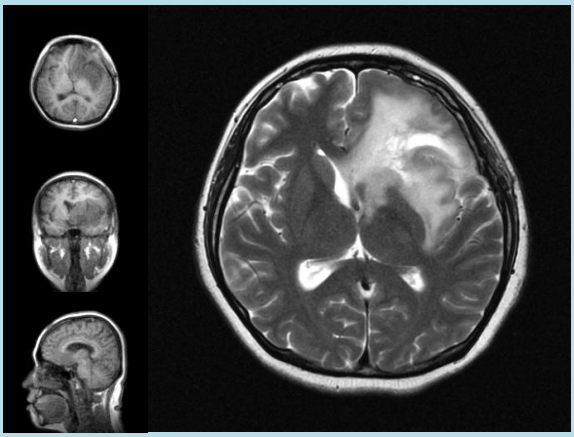
1) Hisako Nagao et al.: Development of automated scan planning for brain using 2D scout images. Excerpt of Plenary and Academic Sessions, Japanese Society of Radiological Technology, 2012.



a



b



c

Fig.6 Clinical images
a: Case of successful recognition by AutoPose.
72 years old, male.
Numerous tumor lesions were observed in the bilateral cerebral white matter and brain stem, showing a state of multiple brain metastases. They are accompanied by edematous changes in the surrounding. They are also accompanied by a mild midline shift to the left.
b: Case of unsuccessful recognition by AutoPose.
74 years old, male.
Large fluid accumulation was observed under the cranial lamina from the left frontal and parietal parts to temporal part. It is accompanied by displacement and midline shift of the cerebral parenchyma.
c: Case of misrecognition by AutoPose.
36 years old, female.
Indistinct neoplastic lesion that shows internally non-uniform signals is observed from the left frontal lobe to the temporal pole and corpus callosum. The mass effect of the tumor displaces the frontal horn of left lateral ventricle, and a mild midline shift is shown.