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Identification of unknown bodies by using CT images of frontal sinus

[Frontal sinüs BT lerinin kullanımı ile kimliği meçhul cesetlerde, kimlik tayini]

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Abstract

Personal identification of unknown bodies by using radiographs of skeletal system has been widely used in forensic medicine. In previous studies direct graphies of frontal sinuses were used for this aim and successful classification systems were defined. In the present study a simple and useful classification system named FSS system (frontal sinus, septum, scalloping) is proposed for CT images. These criteria were selected because of their simplicity and the expectation of inter-investigator bias was negligible. FSS system is applied onto 100 CT images and matches are determined. 57 image patterns had no matches and were discriminated easily. The remaining 43 image patterns had one or more matches but none of them showed more than 6 matches. Exclusion of at least 93 % of image patterns could be possible for a specific image. It is determined that FSS system can be successfully used in forensic medicine in the identification of unknown bodies by using CT images.

Keywords:

Frontal sinus, personal identification, CT.

Özet

Kimliği meçhul iskelet sistemi grafileri kullanılarak kişilerin kimliklendirilmesi adli tıpta yaygın olarak kullanılmaktadır. Daha önceki çalışmalarda frontal sinüsün direkt grafileri kullanılmış ve başarılı klasifikasyon sistemleri tanımlanmıştır. Sunulan çalışmada FSS sistemi (frontal sinüs, septum, skalloping) olarak adlandırılan basit ve kullanışlı klasifikasyon yöntemi CT imajları için önerilmiştir.Basitliği ve araştırmacılar arasındaki farklılığın ihmal edilebilir olması beklentisi nedeniyle bu kriterler seçilmiştir. FSS sistem 100 CT imaj üzerinde uygulanmış ve benzerlikler tanımlanmıştır. 57 imaj örneği benzerlik göstermemiş ve kolaylıkla tanımlanmıştır. Geriye kalan 43 imaj örneği bir veya daha fazla benzerliğe sahip olsa da onlardan hiç biri 6 benzerlikten fazla olmamıştır. İmaj örneklerinin en az %93 ünün reddi spesifik imajlar için mümkün olabilir. FSS sistem, kimliği meçhul kişilerin CT imajları kullanımı ile kimliklendirilmesinde Adli tıpta başarı ile kullanılabilecek bir sistem olarak tanımlanmıştır.

Anahtar Kelimeler:

Frontal sinüs, kimlik tayini, CT.

1. Introduction

Uniqueness of radiographic pattern of frontal sinus to every individual even among monozygotic twins has been established in previous studies.

Frontal sinus has great variability and its structure doesn't change after the age of twenty years except very rare occurrences as fractures, tumors or severe infections.

Radiographs of frontal sinuses are successfully used in today's forensic medicine for identification of a person.

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It is essential to reach an antemortem radiograph of a person for superimposing the antemortem and postmortem graphies for identification.

Computerized tomography is a significant advance in radiology and it is becoming increasingly available and replacing gradually the conventional radiographs.

Therefore, it is possible to provide a paranasal CT scan of a person but not a radiograph.

Currently, only a few studies are present in forensic literature on confirmation of human identification using the CT scans of paranasal sinuses.

2. Aim

The goal of this study is defining a simple and useful system for identification of an unknown person by using CT scans of frontal sinus.

3. Materials and methods

This study was conducted retrospectively on the paranasal sinus CT scans of 2 mm thickness in the axial and coronal planes of 100 cases (38 male and 62 female) taken by a Siemens Emotion Tomography Machine.

The mean age of the cases was 42.11 ± 11.57 (range 20- 69).

No apparent pathology was present in the CT scans.

All measurements were done by the same radiologist with Dicom Viewer program after images transferred to a computer.

Three features and two groups of measurements were obtained from the CT scans and each feature and group of measurements were represented in separated parenthesis.

Three basic features were

F (presence or absence of frontal sinus),

S (septum),

S (scalloping) and named as FSS system and selected as the core of this study.

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1) Both sinuses are present.

2) Two incomplete intrasinus septum at the right side, complete intersinus septum and one complete intrasinus septum at the left side

3) Three scalloping at the right and four at the left side

4. Results

1) Frontal Sinus

Bilateral absence of frontal sinus: wasn't observed.

Unilateral absence of frontal sinus: 4 cases

2) Septum:

A) Intersinus Septum

No intersinus septum: 3 cases

Complete intersinus septum: 96 cases

Incomplete intersinus septum: 1 case

B) Intrasinus Septum

No intrasinus septum: 27 cases

Unilateral intrasinus septum: 32 cases

Bilateral intrasinus septum: 41 cases

Septum:

Right frontal sinus:

Mean: 0.88 ± 0.79 (range 0- 3)

Left frontal sinus

Mean: 0.77 ± 0.91 (range 0- 5)

3) Scalloping

No scalloping: 4 cases

Unilateral scalloping: 8 cases

Bilateral scalloping: 88 cases

Scalloping

Right frontal sinus:

Mean: 2.53 ± 1.32 (range 0- 6)

Left frontal sinus:

Mean: 2.65 ± 1.41 (range 0- 7)

More than 90.000 different frontal sinus patterns were possible in the limits of observations of the study population classified according to the FSS system.

16 pairings had occurred in the study. Maximum matching of the pairings were 7. Even in this situation 93 % of the cases could be eliminated.

Adding measurements was increased more than 59.000 times the possibilities.

By this way 98 % of the cases could be eliminated.

5. Discussion

Identification of an unknown person using radiographs of frontal sinus is an accepted procedure among forensic scientists.

Even some of the authors as Yoshino, Kullman or Harris had proposed to code and use them like fingerprints but until this date nobody could develop a common and accepted formulation of frontal sinus.

In all such studies researchers had used some measurements of radiographs for increasing the discrimination and because of the biases in measurements they always had to compare some cases

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directly.

The authors are proposing a system for negative identification which includes only objective criteria.

Currently, frontal sinus radiographs are used for identification of limited number of person and usually among the suggested people.

Therefore, the superiority of complicated systems which prone to bias to simple systems which can eliminate most of the cases are doubtful.

6. Conclusion

Authors are claiming FSS system for identification of unknown bodies and later if required superimposition of CT scans of paranasal sinuses.,