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Forenzička identifikacija raspadnutih humanih ostataka usporedbom prijesmrtnih i poslijesmrtnih CT prikaza frontalnih sinusa: prikaz slučaja

Forensic Identification of Decomposed Human Body through Comparison between Ante-Mortem and Post-Mortem CT Images of Frontal Sinuses: Case Report

Introduction
Forensic radiology as an emerging branch of forensic sciences plays a valuable role by providing answers about deceased individuals in court procedures, particularly those related to the cause of death (1) and identification of unknown victims (2). In general, it provides solid ante mortem (AM) radiographic evidence for comparison with postmortem findings in human identifications (3) which are registered mainly through conventional dental and maxillofacial radiographs (4). However, in the last few years, computed tomography (CT) has become popular in medical routines and has been...
noj identifikaciji ljudskog tijela u visokom stupnju raspada-nja nakon usporedbe prijesmrtnih i poslije smrtnih forenzič-kih dokaza zabilježenih na CD slikama frontalnih sinusa.

Prikaz slučaja

Godine 2013. pronađeni su ljudski ostatci u visokom stupnju raspada u šumskom području Brazila. Nakon završenog očevida truplo je preneseno u ovlašteni lokalni medicinski-patološki institut. Antropometrijskom analizom ustanovljeno je da je riječ o ženskoj osobi u dobi od 30 do 40 godina (6, 7) i visoko između 158 i 166 centimetara (8). Automobil prebacivanje je izvedeno pomaknut na desnu stranu te nekoliko zuba bilo je izvadeno prije smrti.

Policajci su tijekom istraživanja otkrili i tko je potencijalna žrtva – 33-godišnja žena koja je bila nestala prior to sedam da-nar. Od njezine rodbine zatražen je bilo kakav prijesmrtni medicinski ili zubni podatak kako bi se, radi napretka istra-ge, omogućila kvalitativna identifikacija ljudskih ostataka. To je rezultiralo s 20 aksijalnih snimaka paranasalnih sinu-sa dobivenih multi slice kontrastom iz 2012. (slika 1.). Na trima snimkama jasno se viđala predsjedna i lateralna dimenzija frontalnih sinu-sa, uključujući i njegove režnjeve i pregrade (medijane i do-datne). Nakon toga zatraženi su kompletni DICOM podatci, ali bez uspjeha jer u mjesnoj bolnici nisu pronađene arhivi-rane MSCT slike.

Sličnost između antropološkog profila žrtve i nestale oso-be potaknula je preliminarnu analizu poslije smrtnog frontal-nog sinusa koristeći se postoterionarnom radiološkom sli-kom ljubanje (slika 2.). Pronađeni su frontalni sinusi malih dimenzija i središnji septum pomaknut na desnu stranu te lijevi lobul s većim bočnim proširenjem u usporedbi s nasu-protnim. Nakon toga slijedio je poslijemrtni pregled pomoću kompjutorizirane tomografije kontinuonjom zrakom (CBCT) uredajem CB500 Gendex® (KaVo Kerr Group®, Njemačka), što je omogućilo poslije-srtnu i poslije-smrtnu usporedbu CT podataka (slika 3.). Za pronalažak najboljih poslije-smrtnih presjeka frontalnih sinusa za usporedbu s prijesmrtnima, ko-rišten je preglednik DICOM-a (OsiriX® Pixmeo Sarl®, Švicarska). U neposrednoj usporedbi prijesmrtnih i poslije-smrtnih podataka podudarali su se morfološki nažalosti frontalnih sinusa žrtve i nestale osobe. Točnije, pronađena je slakladnost u boćnom širenju lijevoga režnja i anteroposteriornoj dimen-ziji, te u smještaju središnje i akcesornih koštanih pregrad. Na osnovi ovih dokaza pronađeni ljudski ostatci pozitivno su identificirani.

Rasprava

Sve više zahtjeva za CT pregledne potaknulo je prilagod-bu u usporedbi prijesmrtnih i poslije-smrtnih podataka ko-jaj je, od uspoređivanja konvencionalnih radiografa, došla do tehnoloških naprednih oblika. Od ove promjene najvišíše je koristi imao postupak identifikacije ljudi jer se postiga-pa pouzdana i realnija usporedba forenzičkih podataka (3,

Case report

In 2013, heavily decomposed human remains were found in a forest region in Brazil. After the crime scene investigation, the remains were referred for forensic exams at the local medicotechnological institute. The anthropological analysis pointed to a female victim aged between 30 and 40 years (6, 7), with height ranging from 158mm to 166mm (8). The dental autopsiy revealed the presence of removable partial prostheses and several AM missing teeth.

In parallel, Police acknowledged they believed that a 33-year-old woman who went missing for seven days was the victim of a crime. The relatives of the missing person were asked to provide any AM medical or dental records to support the evidence and enable a comparative human Identification. The search resulted in a sequence of 20 axial images of the paranasal sinuses obtained by Multislice Computed Tomography (MSCT) dating from 2012 (Figure 1). Three images showed clearly the anteroposterior and lateral dimensions of the frontal sinuses, including its lobes and septa (median and accessory). Complete DICOM files were requested resulting unsuccessfully because no record of the MSCT exam was found archived at the local hospital.

The similarity between the anthropological profile of the victim and the missing person led to the PM preliminary analysis of the frontal sinuses using a posteroanterior radiograph of the skull (Figure 2). Bilateral frontal sinuses of small dimensions were observed, as well as a median septum dislocated to the right side and a left lobe with larger lateral expansion compared to the contralateral. Afterwards, a PM cone-beam computed tomography (CBCT) exam was performed using a CB500 Gendex® (KaVo Kerr Group®, Germany) unit enabling the AM/PM CT data comparison (Figure 3). In OsiriX® (Pixmeo Sarl®, Switzerland) DICOM viewer, the PM slices that reproduced the best AM images of the frontal sinuses were searched.

The direct comparison between AM/PM CT data was made and morphological findings of the frontal sinuses of the victim were shown to be consistent with those belonging to the missing person. Specifically, the compatibility between data was found on the lateral expansion of the left lobe, the anteroposterior dimension, and the position of median and accessory septa. An evidence-based positive identification of human remains was established.

Discussion

The increasing demand for CT exams in the routine of medical services triggers a modification in the contemporary AM/PM data, which migrates from the conventional radiographs to more technological imaging modalities. The hu-man identification process benefits from this modification achieving more realistic and reliable comparison of forensic
Slika 1. Aksijalni pogled prijesmrtnih MSCT slika - datirano 2012.
Figure 1 Axial view of the computed tomography images obtained ante-mortem, dating from 2012.

Slika 2. Radiološka morfologija frontalnih sinusa dobivena poslijesmrtno vidljiva u posteroanteriornom radiogramu lubanje - datirano 2013.
Figure 2 Radiographic morphology of the frontal sinuses observed in the post-mortem posteroanterior radiograph of the skull, dating from 2013.

Slika 3. Usporedba prijesmrtnih (AM) i poslijesmrtnih (PM) slika s prikazom donjih (A), srednjih (B) i gornjih (C) regija frontalnih sinusa.
Figure 3 Comparison between ante-mortem (AM) and post-mortem (PM) images showing the inferior (A), intermediate (B) and superior (C) regions of the frontal sinuses.
Identifikacija ljudskog tijela korištenjem CT prikaza frontalnih sinusa
Ferreira Silva i sur.

9). Korištenje slika visoke tehnološke razine važno je u složenim slučajevima raspadnutih/ostičenih tijela i tjelesnih ostataka kojima često nedostaju meka tkiva i otisci prstiju (5, 10). Znanstvena literatura podupire radiografsku analizu frontalnih sinusa u svrhu identifikacije na temelju karakterističnih morfoloških obilježja (11) te niske prevalencije njihove age- neze (12). Tradicionalno se frontalni sinusi procjenjuju s pomoću anteroposteriornih radiograma lubanje (11, 13), te se na njima obavljaju analize vertikalne i horizontalne dimenzije. Analiza anteroposteriornih dimenzija nije moguća zbog dvodimenzijskog prikaza (2D) tehnike (11, 13). Unatoč tomu što u ovom slučaju potpuni DICOM podatci CT pretrage nisu bili na raspolaganju, oni bi mogli omogućiti volumetrijsku (3D) dimenziju analizu (14, 15) te poboljšati interpretacijske dokaze u svrhu pozitivne identifikacije. Osim trodimenzijne analize (3D), važno je istaknuti i noviju literaturu u kojoj se istražuje potencijalno korištenje snimljenih radiograma (2D) paranasalnih sinusa (16). Tako su, na primjer, mjereni maksišarni sinusi radi razlikovanja spolova, kao korist pri rekonstruktivnoj identifikaciji u forenzičkoj antropologiji (16). Stoviše, takve procjene biološkog profila žrtava prijeku su potrebne zbog mogućeg sužavanja popisa nestalih osoba, posebno u složenim slučajevima poput nesreća s više žrtvama (16). Štoviše, takve procjene su nužne zbog mogućeg sužavanja popisa nestalih osoba, posebno u složenim slučajevima poput nesreća s više žrtvama (16).

Dodatno područje relevantnosti prikazanog slučaja jest uspoređivanje prijesmrtnih MSCT slika s posljesmrtnim CBCT-om. Iako se MSCT uredaji uobičajeno koriste u medicinske svrhe, još nisu postali standardni sastavni dio ovlaštenih medicinsko-patoloških ustanova diljem svijeta. U opisanom slučaju CBCT se pokazao kao alternativa za dobivanje sličnih posljesmrtnih slika za analizu i usporedbu s dobivenim aksijalnim prijesmrtnim slikama. Do ovog prikaza slučaja u literaturi nema izvještaja u kojem je provedena uspješna identifikacija ljudskih ostataka isključivo na temelju morfoloških forenzičkih dokaza dobivenih na CT aksijalnim slikafrontalnih sinusa.

Zaključak

Opisani slučaj pokazuje koliko je važno pravilno čuvati medicinske nalaze i koliko su nužni u pravosuđu. Dodatno, prikazana je važnost interpretacije CT prikaza frontalnih sinusa u slučaju kada su oni jedini izvor za forenzičke dokaze.

Sukob interesa

Autori nisu bili u sukobu interesa.

Conflict of interest

None declared
Abstract

Objective: The aim of this paper is to report on a case of positive human identification of a decomposed body after the comparison of ante-mortem (AM) and post-mortem (PM) computed tomography images of frontal sinus. Case report: An unknown, highly decomposed human body, aged between 30 and 40 years, was found in a forest region in Brazil. The dental autopsy revealed several teeth missing AM and the presence of removable partial prostheses. The search for AM data resulted in a sequence of 20 axial images of the paranasal sinuses obtained by Multislice Computed Tomography (MSCT). PM reproduction of the MSCT images was performed in order to enable a comparative identification. After a direct confrontation between AM/PM MSCT, the data were collected for morphological findings, specifically for the lateral expansion of the left lobe, the anteroposterior dimension, and the position of median and accessory septa of the sinuses. Conclusion: The importance of storing and interpreting radiographic medical data properly is highlighted in this text, thus pointing out the importance of application of forensic radiology in the field of law.

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