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Urednik suplementa/ Supplement editor:
Sašo Arnuga
saso.arnuga@zf.uni-lj.si

Uredniški odbor suplementa / Supplement editorial board:
Gašper Podobnik
Janez Podobnik

Naslov uredništva / Editorial office:
Zdravstvena pot 5
1000 Ljubljana
Slovenia
Tel.: 01/300-11-51
E-mail: nejc.mekis@zf.uni-lj.si

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Bilten je uradna revija Društva radioloških inženirjev Slovenije, z zunanjimi Recenzijami.
Bilten je namenjen objavi člankov z vseh področij diagnostičnega slikanja (diagnostčna radiološka tehnologija, CT, MR, UZ in nuklearna medicina) ter terapevtske radiološke tehnologije in onkologije. Članki so strokovni in znanstveni: rezultati raziskovalnega dela, tehnološke ocene, opisi primerov itd.
V Biltenu objavljamo tudi sindikalne novosti ter informacije o izobraževanju, hkrati pa omogoča tudi izmenjavo informacij in mnenj radioloških inženirjev.

The Bulletin is an official journal of the Society of Radiographers of Slovenia with external reviews. The purpose of the Bulletin is to publish articles from all areas of diagnostic imaging (diagnostic radiologic technology, CT, MR, US and nuclear medicine), therapeutic radiologic technology and oncology.
The articles are professional and scientific: results of research, technological assessments, descriptions of cases, etc. The Bulletin also contains trade union news and information about education and training, in addition to offering the opportunity to radiographers to exchange information and opinions.

Predgovor

Spoštovani!

Pred vami je Zbornik povzetkov predavanj in posterjev, ki je nastal v okviru 5. kongresa Strokovnega združenja radioloških inženirjev Slovenije. Veseli nas, da se po dolgem času zaradi pandemije življenje počasi vrača v stare tirnice in tako tudi naše združenje zopet organizira kongres. Veseli nas, da je bil interes in odziv za prijavo na kongres tako velik, saj smo že v prvih nekaj tednih zapolnili vse kapacitete nastanitve in predavalnice.

Predavanja in posterji so v tej publikaciji objavljeni v obliki izvlečkov tako v slovenskem kot angleškem jeziku. Kongres Strokovnega združenja radioloških inženirjev je poleg strokovnega in znanstvenega izpopolnjevanja, izmenjave mnenj in snovanja novih projektov tudi priložnost za druženje članov, saj se tega srečanja udeleži največ radioloških inženirjev iz celotne Slovenije, kot vsako leto pa imamo tudi nekaj gostov iz sosednjih držav. Zato me zelo veseli, da se nadaljuje ta tradicija.

Na tokratnem kongresu bomo poslušali zanimive teme in predstavitev novosti in novih dognanj iz vseh področij našega dela. Predavanja naših kolegov so na ravni največjih dogodkov na mednarodni ravni.

Izvedba kongresa ne bi bila mogoča brez vašega sodelovanja, tako s pripravo vaših prispevkov kot udeležbo na srečanju. Veseli me, da je vedno več ljudi pripravljenih pomagati pri organizacijskih delih, kar terja veliko časa, energije in zagona.

Zahvaljujem se tudi vsem sponzorjem, ki nam pomagajo pri izvedbi kongresa. Upam, da vam bo prebiranje tega zbornika in udeležba na kongresu vzbudila željo po aktivnem sodelovanju in boste z vašim prispevkom sodelovali v redni številki revije Medical Imaging and Radiotherapy Journal, ali na naslednjem kongresu ZDRI oz. na kakšnem drugem srečanju radioloških inženirjev doma ali po svetu. Zavedati se moramo, da bomo samo z znanjem, in z dokazi podprto prakso pripomogli k rasti, razvoju, samostojnosti, prepoznavnosti in ugledu našega poklica.

Nejc Mekiš,
predsednik Strokovnega združenja
radioloških inženirjev Slovenije
Ljubljana, maj 2022

Spoštovani!

Veseli nas, da nam je po dolgem premoru uspelo organizirati kongres in da ob tej priložnosti izdajamo zbornik izvlečkov predavanj in plakatov.

V suplementu revije MIRTJ so objavljeni izvlečki predavanj in plakatov, ki so bili predstavljeni na kongresu. Velik interes za aktivno udeležbo na kongresu nam pove, da se zavedamo, da je raziskovanje pomembno za napredek naše stroke.

Zahvaljujem se vsem sodelujočim avtorjem, predavateljem, recenzentom, moderatorjem ter strokovnemu in organizacijskemu odboru, brez katerih izvedba kongresa ne bi bila mogoča.

Sašo Arnuga,
podpredsednik Strokovnega združenja
radioloških inženirjev Slovenije
urednik suplementa MIRTJ
Ljubljana, maj 2022

vsebina

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PREDNOSTI IN SLABOSTI DVOSPEKTRALNE CTA PLJUČNIH ARTERIJ V PRIMERJAVI Z ENOSPEKTRALNO CTA PLJUČNIH ARTERIJ

ADVANTAGES AND DISADVANTAGES OF DUAL-ENERGY PULMONARY CTA COMPARED TO SINGLE ENERGY PULMONARY CTA

Aleš Kaučič [1], Hana Žitnik [2]

[1] Univerzitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

[2] Univerzitetna Klinika za pljučne bolezni in alergijo Golnik, Oddelek za diagnostično in intervencijsko radiologijo, Golnik 36, 4204 Golnik, Slovenija / University Clinic Golnik, The Department of Diagnostic and Interventional Radiology, Golnik 36, 4204 Golnik, Slovenia.

Korespondenca / Corresponding author: ales.kaucic@gmail.com

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IZVLEČEK

Uvod in namen: Primerjali smo razliko v dozi ($CTDI_{vol}$ in DLP) med dvospektralno (DE) CTA pljučnih arterij in klasično enospektralno (SE) CTA pljučnih arterij in razliko med atenuacijskimi vrednostmi v pljučnih arterijah. Na praktičnih primerih smo izpostavili razlike v tehnični izvedbi ter opisali prednosti in slabosti dvospektralnega slikanja.

Metode: Retrospektivno smo primerjali 90 preiskav, narejenih na napravi Dual Source CT Siemens Somatom Drive; ena skupina SE CTA z avtomatsko izbiro kV (Care kV) in druga skupina DE CTA z nastavitvijo 80/Sn140 kV in 100/Sn140 kV pri pacientih z višjim ITM. Pri vseh DE CTA smo s programom syngo.via naredili monoenergijske rekonstrukcije. Radiolog je pri vseh preiskavah v pljučnih arterijah izmeril atenuacijske vrednosti in preiskave ocenil kot diagnostične ali ne-diagnostične s kriterijem minimalno 250 HU v pljučnem deblu. S programom IBM SPSS Statistics v.25 smo naredili Shapiro-Wilkov test normalnosti in t-test neodvisnih vzorcev; rezultati kažejo normalno porazdelitev vseh vzorcev.

Rezultati: Med vzorcema ni bilo statistično pomembne razlike v ITM ($p = 0,056$). Povprečna vrednost $CTDI_{vol}$ pri SE CTA je bila 4,2 mGy, pri DE CTA 5,8 mGy. Povprečna vrednost DLP pri SE CTA je bila 130,6 mGy.cm, pri DE CTA 182,6 mGy.cm. Vrednosti so nižje od priporočenih DRL vrednosti (13 mGy za CTDIvol in 440 mGy.cm za DLP). Opazili smo statistično pomembno razliko v $CTDI_{vol}$ ($p < 0,001$) in DLP vrednosti ($p < 0,001$) s povprečno 38,1 % povišanjem $CTDI_{vol}$ in 39,8 % povišanjem DLP pri DE CTA glede na povprečje SE CTA. V skupini SE CTA so bile 3 preiskave ocenjene kot ne-diagnostične, v skupini DE CTA so bile vse preiskave ocenjene kot diagnostične. Povprečne HU vrednosti v pljučnem deblu so bile pri SE CTA 547,8 HU, pri DE CTA 519,5 HU, pri monoenergijskih rekonstrukcijah 1553,9 HU. Med SE CTA in DE CTA ni bilo statistično pomembne razlike v HU vrednosti ($p = 0,564$). Statistično pomembna razlika v HU vrednostih je bila med SE CTA in monoenergijskih rekonstrukcijah ($p < 0,001$) in med DE CTA in monoenergijskih rekonstrukcijah ($p < 0,001$).

Razprava in zaključek: Ugotovili smo, da je pri DE CTA v povprečju doza višja kot pri SE CTA. Pri vseh DE CTA preiskavah smo pri monoenergijskih rekonstrukcijah opazili občutno povišanje HU vrednosti in izboljšan prikaz pljučnih arterij. Glavna pomanjkljivost DE CTA je v našem primeru lastnost DSCT naprave. Zaradi manjšega slikovnega polja kakovostna DE CTA ni izvedljiva pri pacientih z visokim ITM. DE CTA je kljub višji dozi dobra alternativa klasični SE CTA, ker ponuja izdelavo novih vrst rekonstrukcij z občutnim izboljšanjem prikaza pljučnih arterij, rekonstrukcij za izboljšan prikaz pljučnega intersticija in rekonstrukcij za prikaz perfuzije pljuč. Hkrati je z možnostjo ustvarjanja monoenergijskih rekonstrukcij DE CTA pljučnih arterij možno izvesti z nižjo količino jodnega kontrastnega sredstva.

Ključne besede: dvospektralni CT, pljučna embolija, angiografija

ABSTRACT

Introduction and purpose: We compared the difference in dose ($CTDI_{vol}$ and DLP) between dual-energy (DE) Pulmonary CTA and single-energy (SE) pulmonary CTA, and the difference in attenuation values measured in the pulmonary truncus.

Methods: In a retrospective study we compared 90 examinations performed on the same dual source CT scanner Siemens Somatom Drive; one group SE pulmonary CTA with automated kV adjustment (Care kV), the second group DE pulmonary CTA with 80/Sn140 kV and 100/Sn140 kV settings for patients with higher BMI. With syngo.via software we reconstructed monoenergetic images in all DE CTA examinations. A radiologist measured HU values in the pulmonary truncus in all examinations and assessed whether the examination is diagnostic with a minimal cut off value of 250 HU. We performed a Shapiro-Wilk test to test for normality and independent samples t-tests with the IBM SPSS Statistics v.25 programme.

Results: There was no statistically significant difference in BMI between both groups (p=0.056). The average measured $CTDI_{vol}$ values were 4.2 mGy for SE CTA and 5.8 mGy for DE CTA. The average DLP values were 130.6 mGy.cm for SE CTA and 182.6 mGy.cm for DE CTA. All values were below the published DRLs recommendation (13 mGy for $CTDI_{vol}$ and 440 mGy.cm for DLP respectively). There was a statistically significant difference in $CTDI_{vol}$ ($p < 0.001$) and DLP ($p < 0.001$) values with an average 38.1% increase in $CTDI_{vol}$ and a 39.8% increase in DLP values for DE CTA compared to average values for SE CTA. In the SE CTA group 3 examinations were assessed as non-diagnostic, in the DE CTA group all examinations were assessed as diagnostic. The average HU values measured in the pulmonary truncus were 547.8 HU for SE CTA, 519.5 HU for DE CTA and 1553.9 HU for monoenergetic images. There was no statistically significant difference in HU values between SE CTA and DE CTA (p=0.564). There was a statistically significant difference in HU values between SE CTA an monoenergetic images ($p < 0.001$), and between DE CTA and monoenergetic images ($p < 0.001$).

Conclusion: We concluded that DE CTA is accompanied with an increased dose penalty, compared to SE CTA. Monoenergetic images assessed from the DE CTA examinations showed greatly increased HU values and improved pulmonary artery depiction. Despite higher dose values, DE CTA is a good alternative to SE CTA owing to high HU values in monoenergetic images, which enhances pulmonary artery depiction and reduces the chance of a non-diagnostic examination.

Keywords: dual energy computed tomography, pulmonary embolism, angiography

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PROTOKOLI ZA SLIKANJE JETER Z RAČUNALNIŠKO TOMOGRAFIJO

LIVER COMPUTED TOMOGRAPHY IMAGING PROTOCOLS

Benjamin Duh, Jure Mišič, Irena Lopatič

Univerzitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: benni.duh@gmail.com

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IZVLEČEK

Uvod: Računalniška tomografija (CT) ima ključno vlogo pri določanju diagnoze, stopnje bolezni, načrtovanju in vrednotenju zdravljenja kot tudi pri spremljanju bolnikov z znanimi boleznimi jeter ali s sumom na bolezni jeter. Za kakovostno slikanje patologij v jetrih in s tem njihovo karakterizacijo se uporabljajo različne faze slikanja. Jetra lahko slikamo z ali brez uporabe kontrastnega sredstva (KS), v različnih časovnih obdobjih po aplikaciji KS. Različne faze slikanja nam služijo za identifikacijo patologij v jetrih.

Namen: Namen prispevka je predstavitev pomembnosti izbire pravilnega protokola za CT slikanje jeter.

Metode: Uporabili smo kvalitativno raziskovalno metodologijo s pregledom literature in pregledom obstoječih protokolov na Kliničnem inštitutu za radiologijo (KIR) UKC Ljubljana. V teoretičnem delu je bila uporabljena deskriptivna metoda dela, opravili smo pregled strokovne literature in znanstvenih člankov s pomočjo podatkovnih baz COBISS, MEDLINE, CHINAL.

Rezultati in razprava: Po pregledu obstoječe literature smo z zdravniki radiologi optimizirali protokol za CT slikanje jeter na KIR UKC Ljubljana. Pri omenjenem protokolu smo prilagodili hitrost aplikacije KS in količino KS ter s tem izboljšali kontrastnost jetrnih patologij. Uporaba pravilnih protokolov za CT slikanje jeter, optimizacija količine in hitrosti aplikacije KS in izbira ustrezne faze slikanja so ključni za kakovostno CT slikanje jeter, ki ne omogoča le odkrivaje lezij, temveč tudi njihovo karakterizacijo. Metoda je zlasti pomembna za zanesljivo ugotavljanje, ali so majhne lezije benigne ali maligne.

Zaključek: Pri pregledu obstoječih protokolov za slikanje abdomna na Kliničnem inštitutu za radiologijo UKC Ljubljana smo ugotovili, da je pravilna izvedba ključna za pravilen prikaz jetrnih patologij. Protokoli za slikanje jeter bi morali biti standardizirani med posameznimi ustanovami. Na ta način bi dosegli primerljivost preiskav med ustanovami, saj bi bile patologije jeter vedno prikazane na enak način. S tem bi se izognili centralizaciji CT slikanj jeter ter ponovni dozni in kontrastni obremenitvi pacienta. Radiološki inženirji morajo poznati pomen izbire primernega protokola za slikanje jeter pri posamezni diagnozi in sodelovati z radiologi pri izbiri primernega protokola za slikanje.

Ključne besede: računalniška tomografija, jetra, kontrastno sredstvo

ABSTRACT

Introduction: Computed tomography (CT) plays an important role in diagnosis, disease staging, treatment planning and evaluation, and monitoring of patients with known or suspected liver disease. Different phases of imaging are used to provide the high-quality visualization of pathology in the liver and thus to characterize it. The liver can be imaged with or without the use of a contrast agent (CA) at different time periods after CA application. Different phases of imaging help us to identify pathologies in the liver.

Purpose: The purpose of this paper is to present the importance of choosing the right protocol for the CT imaging of the liver.

Methods: We used a qualitative research methodology with a review of literature and a review of existing protocols at the Clinical Institute of Radiology (KIR) at the UKC Ljubljana. In the theoretical part, the descriptive working method was used. We reviewed professional literature and scientific articles using the COBISS, MEDLINE, CHINAL databases.

Results and discussion: After reviewing existing literature, we optimized the protocol for the CT imaging of the liver at KIR UKC Ljubljana with the help of radiologists. In the aforementioned protocol, we adjusted the rate of CA application and the amount of CA, and thus improved the contrast of liver pathologies. Using the right protocols for the CT imaging of the liver, optimizing the amount and rate of CA application, and selecting the appropriate phase of imaging are key to the high-quality CT imaging of the liver, which allows not only the detection of lesions but also their characterization. The method is particularly important for reliably determining whether small lesions are benign or malignant.

Conclusion: After reviewing the existing protocols for CT abdominal imaging at the Clinical Institute of Radiology, University Medical Centre Ljubljana, we found that proper implementation is critical for the correct presentation of liver pathologies. Liver imaging protocols should be standardized between institutions. In this way, comparability between institutions would be achieved, as liver pathologies would always be presented in the same way. This would avoid the centralization of CT scans of the liver and the re-dosing and contrast exposure of the patient. Radiographers should be aware of the importance of selecting an appropriate liver imaging protocol for each diagnosis and work with radiologists to select an appropriate imaging protocol.

Keywords: computed tomography, liver, contrast medium

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VLOGA RADIOLOŠKEGA INŽENIRJA V FORENZIČNI RADIOGRAFIJI – PREDSTAVITEV PRIMEROV

THE ROLE OF THE RADIOGRAPHER IN FORENSIC RADIOGRAPHY – CASE PRESENTATION

Hedvika Šauperl

Univerzitetni klinični center Maribor, Radiološki oddelek, Ljubljanska ulica 5, 2000 Maribor, Slovenija /
University medical centre Maribor, Department of Radiology, Ljubljanska ulica 5, 2000 Maribor, Slovenia

Korespondenca / Corresponding author: sauperl.hedvika@siol.net

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IZVLEČEK

Uvod in namen: Forenzična radiologija je specializirano področje medicinskega slikanja z uporabo radioloških tehnik za pomoč patologom in antropologom pri ugotavljanju vzroka smrti ali identifikaciji posmrtnih ostankov. Radiološki inženirji imajo ključno vlogo pri radioloških forenzičnih preiskavah. Rentgenske slike so primerne za oceno zlomov kosti, zbiranja plinov ter identifikacijo in lokalizacijo radiopačnih tujkov. Predstaviti želim izkušnje radioloških inženirjev pri slikanju pokojnikov na Oddelku za patologijo v UKC Maribor.

Metode: Retrospektivno sem primerjala preiskave šestih pokojnikov v obdobju od junija 2021 do februarja 2022. Pri dveh pokojnikih smo opravili slikanje glave, pri eni pokojnici smo slikali celo telo, pri eni pokojnici smo iskali poškodbe skeleta, trupli dveh pokojnikov sta bili v tako slabem stanju, da smo slikali celo telo. Radiološke preiskave smo opravili z digitalnim mobilnim aparatom Canon Mobirex v prostorih Oddelka za patologijo. Uporabili smo velik detektor 35x43 cm, brez rešetke. V vseh primerih sta slikanje opravljala dva radiološka inženirja; eden je upravljal z aparatom, drugi pa je s pomočjo obdukcijskega pomočnika premeščal detektor pod pokojnikom ter po potrebi prilagajal položaj trupel.

Rezultati in razprava: Kakovost radiogramov zaradi pogojev slikanja ni primerljiva z radiogrami, ki jih pridobimo pri našem standardnem delu na skeletnih diagnostikah. Na kakovost radiogramov vplivajo teža pokojnika, ohranjenost in položaj trupel ter prisotnost medicinskih kovinskih vsadkov. Pravilno premeščanje detektorja pod pokojniki je predstavljalo izziv zaradi teže trupel, kovinskih vozičkov ter zatikanja vreče z detektorjem v vrečo s pokojnikom. Izvidi radiologov niso bili potrebni.

Zaključek: Klasično rentgensko slikanje skeleta patologom olajša delo pri oceni zlomov kosti, zbiranja plinov ter identifikacijo in lokalizacijo radiopačnih tujkov. Radiološke preiskave pokojnikov predstavljajo strokovni izziv za vsakega radiološkega inženirja, saj mora za pridobitev optimalnih radiogramov pozabiti na predsodke, predvsem pa uporabiti vse svoje pridobljeno znanje, izkušnje, spretnosti, iznajdljivost ter sposobnost improvizacije.

Ključne besede: radiološki inženir, forenzika, radiografija

ABSTRACT

Introduction and purpose: Forensic radiology is a specialised field of medical imaging using radiological techniques to assist pathologists and anthropologists in determining the cause of death or identifying remains. Radiographers play a key role in radiological forensic examinations. X-ray images are suitable for the assessment of bone fractures, gas collection and the identification and localisation of radiopaque foreign bodies. I would like to present the experience of radiographers in imaging the deceased at the Department of Pathology, UMC Maribor.

Methods: I retrospectively compared the investigations of six deceased patients in the period from June 2021 to February 2022. Two deceased had head imaging, one deceased had full body imaging, one deceased was searched for skeletal injuries, the bodies of two of the deceased were in such a bad condition that we took pictures of the whole body. Radiological examinations were performed using a Canon Mobirex digital mobile machine in the Department of Pathology. We used a large 35x43 cm detector, without a grid. In all cases, two radiographers performed the imaging; one operated the machine, while the other radiographer, with the help of a post-mortem assistant, moved the detector under the deceased and adjusted the position of the bodies as needed.

Results and discussion: The quality of the radiographs is not comparable to the radiographs obtained in our standard skeletal diagnostic work-up due to the imaging conditions. The quality of the radiographs is influenced by the weight of the deceased, the preservation and position of the corpse, and the presence of medical metal implants. Moving the detector correctly under the deceased posed a challenge due to the weight of the bodies, the metal trolleys and the detector bag getting stuck in the deceased's bag. No radiology reports were required.

Conclusion: Conventional skeletal X-ray imaging facilitates the work of pathologists in the assessment of bone fractures, gas collection and the identification and localisation of radiopaque foreign bodies. Radiological examinations of the deceased represent a professional challenge for every radiographer, who must ignore prejudices and, above all, use all their knowledge, experience, skills, ingenuity and improvisation to obtain optimal radiographs.

Keywords: radiographer, forensics, radiography

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Dnevna nastavitev je zaključena v manj kot 2 minutah.

Vstavitev dnevnega seta | Nastavitev tekočin | Priključitev linije za bolnika

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Samodejno dokumentiranje

Integriran čitalnik črtnih kod na injektorju omogoča lažji vnos in sledljivost kontrastnega sredstva in injiciranja.

Različne konfiguracije

Montaža na mobilnem stojalu z baterijskim napajanjem in Wi-Fi povezavo. Na voljo je tudi stropna montaža (OCS).

PP-M-CEN-SI-0009-1 April 2021

KLINIČNA PRESOJA V RADIOLOŠKI TEHNOLOGIJI

CLINICAL AUDIT IN RADIOLOGIC TECHNOLOGY

Alenka Matjašič [1], Nejka Jerneja Pečnik [2], Tina Starc [1]

[1] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical Imaging and Radiotherapy Department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

[2] Splošna bolnišnica Slovenj Gradec, Gosposvetska cesta 3, 2380 Slovenj Gradec, Slovenija / General hospital Slovenj Gradec, Gosposvetska cesta 3, 2380 Slovenj Gradec, Slovenia

Korespondenca / Corresponding author: matjasic.alenka@gmail.com

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IZVLEČEK

Uvod: Klinična presoja je primerjanje kliničnih protokolov in vidikov dela z določenimi standardi z namenom dviga kakovosti dela in optimizacije procesov v zdravstvu.

Namen: Namen dela je predstaviti pojem klinične presoje v radiološki tehnologiji, stanje na tem področju v Sloveniji in mnenja predstavnikov stanovskih organizacij ter radioloških oddelkov glede vpeljevanja klinične presoje.

Metode dela: Uporabili smo metodo pregleda literature in deskriptivno metodo za opis obstoječega stanja v Sloveniji. Raziskava je potekala od decembra 2018 do marca 2019. Za zbiranje podatkov smo uporabili metodo intervjuja. Dobljene podatke smo analizirali s kodiranjem, na koncu pa smo skušali oblikovati utemeljeno teorijo.

Rezultati: Oblikovali smo utemeljeno teorijo o tem, kaj klinična presoja predstavlja strokovnjakom v Sloveniji. Ti navajajo pregled in primerjavo standardov glede urejanja dokumentacije, delovanja sistema in oddelka ter samega izvajanja preiskav z namenom izboljšanja kakovosti dela. Presojamo lahko protokole, doze in dozimetrijo, korake klinične poti od sprejema do odpusta pacienta. Klinična presoja bi morala biti obvezna za vse udeležene v delovnem procesu na radiološkem oddelku, njene ugotovitve pa upoštevane, če želimo zagotoviti kakovostno delo na oddelku. Presoja je lahko notranja ali zunanja. Izvajajo jo radiološki inženirji skupaj s predstavniki krovnih organizacij in sorodnih profilov z ustreznimi dokazili o znanju.

Razprava in zaključek: V veliki meri se naši rezultati skladajo s smernicami Evropskega radiološkega društva (*European Society of Radiology* – ESR) glede izvajanja klinične presoje, npr. glede tega, kaj je klinična presoja obsega in čemu je namenjena. Opazili smo neskladje pri rezultatih, ki zadevajo ukrepanje ob nepravilnostih. Pojem klinične presoje morda v radiološki tehnologiji med slovenskimi strokovnjaki še ni jasno ločen od pojma inšpekcijskega in drugih oblik nadzora. Predstavniki stroke in strokovna literatura so si enotni, da je pri klinični presoji bistven dvig kakovosti dela radioloških inženirjev.

Ključne besede: klinična presoja, presoja v zdravstvu, smernice ESR, klinična presoja v radiološki tehnologiji

ABSTRACT

Introduction: Clinical audit refers to comparing clinical protocols and work aspects to certain standards with the purpose of raising quality and optimising processes in healthcare.

Purpose: The purpose of this paper is to present the term clinical audit in radiologic technology, the current situation in Slovenia and the opinions of institution representatives regarding the introduction of clinical audit in practise.

Methods: We used the literature review method and the descriptive method to represent the current state in Slovenia. The research was conducted from December 2018 to March 2019. We used the interview to gather information. The data were analysed using coding and a grounded theory was later formed.

Results: Forming a grounded theory led to the conclusion that clinical audit to our interviewees means a review and comparison of standards for different examinations, proper documentation and the workflow of the department itself. Its purpose is improving the quality of work. We can audit protocols, dose levels and dosimetry, and the entire clinical path of a patient. Clinical audit should be obligatory for everyone involved in the work process in a department for radiology. Audit results and suggested measures should be followed to ensure the quality of work. If the measurements are not followed, action should be taken. An audit can be internal or external. It can be managed by radiologic technologists or competent representatives of relevant institutions.

Discussion and conclusion: Our results are to a great extent similar to what the guidelines of the European Society of Radiology (ESR) propose for carrying out clinical audits, their range and purpose. We have noticed some differences in the field of penalisation. The difference between clinical audit and inspection or supervision is not clearly expressed in interviewees' opinions. Our experts' opinion is in agreement with the literature in that they also believe that the main purpose of a clinical audit is to ensure better quality of work.

Keywords: clinical audit, audit in healthcare, ESR guidelines, clinical audit in radiologic technology.

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KLINIČNI POMEN SLIKANJA HRBTENICE V STOJEČEM POLOŽAJU

CLINICAL IMPORTANCE OF SPINE IMAGING IN STANDING POSITION

Marija Jeglič

Univerzitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: marija.jeglic@gmail.com

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IZVLEČEK

Uvod: Slikanje hrbtenice je standardna slikovna metoda, ki dopolnjuje klinični pregled pacienta z bolečinami v hrbtu. Redno jo uporabljamo pri pacientih z deformirano hrbtenico, ki se običajno bolj zavedajo bolečinskih simptomov, medtem ko stojijo, in ne toliko, ko ležijo. Zato je slikanje v stoječem položaju ključno za pridobitev informacij o dejanskem stanju hrbtenice.

Namen: V prispevku so opisani klinični razlogi za napotitev pacienta z deformirano hrbtenico na rentgensko slikanje in možnosti izboljšanja rentgenske slikovne diagnostike v klinični praksi.

Metode: Pregled literature in opis primera. Primer pokaže razliko med rentgenogrami ledvene hrbtenice iste pacientke, slikane v ležečem in stoječem položaju.

Rezultati: Raziskave izpostavljajo statistično značilne razlike med meritvami v stoječem in ležečem položaju pri rentgenski preiskavi hrbta. Najbolj očitne razlike so pri oceni ledvene lordoze, Cobbovem kotu, rotacijami vretenc, nagibu medenice, zdrsu vretenc in zožitvi intervertebralnih foramnov.

Razprava: Prikazane deformacije hrbtenice se bodisi zaradi sile gravitacije bodisi zaradi naravne rotacije vretenc razlikujejo glede na to, ali pacient leži ali stoji. Glede na raziskave to sovpada z bolečinsko simptomatiko pacienta z deformacijo hrbtenice, zato bi bilo smiselno slikati hrbtenico takšnega pacienta v stoječem položaju, če zdravstveno stanje pacienta to omogoča. Slikovni sistem EOS predstavlja dobro izbiro, če si ga lahko privoščimo, saj omogoča hkratno zajemanje frontalnega in lateralnega rentgenograma.

Zaključek: Analiza literature potrjuje klinični vtis, da se na rentgenogramih hrbtenice v stoječem položaju večina deformacij prikaže v večjem obsegu kot pri ležečem položaju. Zato je pri kliničnem pregledu pacienta z bolečino ob prisotni deformaciji hrbtenice smiselna uporaba rentgenske preiskave hrbtenice stoje, ko je to mogoče in ob upoštevanju načel ALARA (angl. *as low as reasonably achievable*). Pri tem si lahko pomagamo s pripomočki za stabilizacijo pacientov.

Ključne besede: slikanje stoje, deformacija hrbtenice, slikanje hrbtenice, lordoza, skolioza

ABSTRACT

Introduction: Spine x-ray imaging represents a standard x-ray imaging technique as part of a clinical examination of patients with spine deformities when experiencing back pain. These patients with spine deformities are usually more aware of symptoms when standing and not as much when lying down. Therefore, taking x-rays while standing is crucial to obtain important information about the actual condition of the spine.

Purpose: The paper describes clinical reasons for appointing a patient with a deformed spine on X-ray imaging and possibilities of improving X-ray imaging diagnostics in clinical practice.

Methods: Literature review and case description. The case shows the difference between lumbar spine radiographs of the same patient, taken in the supine and standing position.

Results: The studies highlight statistically significant differences between standing and lying down X-rays image measurements. The most obvious differences are in lumbar lordosis, Cobb angle, vertebral rotations, pelvic tilt, vertebral slippage, and foramen narrowing.

Discussion: The radiographs of spine deformities differ when the patient is lying down or standing up because of gravity load or the natural rotation of the vertebrae. According to the research, this coincides with the pain symptoms of a patient with spinal deformity, so it would make sense to use X-ray imaging of the spine in such a patient in a standing position if the patient´s medical condition allows it. EOS technology is a good option if it can be afforded, because it allows simultaneous acquisition of frontal and lateral images.

Conclusions: An analysis of the literature confirms the clinical impression that most deformities appear on the radiographs of the spine in the standing position largely than in the supine position. Therefore, in the clinical examination of a patient in pain in the presence of spinal deformity, it is clinically justified to use X-ray examination of the spine standing up, when possible and taking into account the principles of ALARA (as low as reasonably achievable). Patient stabilization aids can help.

Keywords: standing x-rays imaging, spine deformation, lordosis, scoliosis

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UMIK MEHKEGA TKIVA PRI SLIKANJU MEDENICE STOJE: PRIMERJAVA DOZNE OBREMENITVE IN KAKOVOSTI RENTGENOGRAMA

FAT TISSUE DISPLACEMENT IN ERECT PELVIC RADIOGRAPHY: COMPARISON OF RADIATION DOSE AND IMAGE QUALITY

Šejla Trožić [1,3], Andrew England [2], Nejc Mekiš [3]

[1] Univezitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

[2] University College Cork, Department of Radiography, Cork, Ireland

[3] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical Imaging and Radiotherapy Department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: sejla.trozic1997@gmail.com

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IZVLEČEK

Uvod in namen: V primerjavi s slikanjem medenice leže je pri slikanju medenice stoje višja doza in slabša kakovost rentgenograma. Namen raziskave je bil ugotoviti, ali se kakovost rentgenogramov in prejeta doza razlikujeta pri dveh različnih načinih slikanja medenice stoje – z odmikom in brez odmika mehkega tkiva.

Metode dela: Prvi del je obsegal meritve na fantomu, kjer smo izbrali trak, ki ni povzročal vidnih artefaktov na rentgenogramu pri odmiku tkiva med preiskavo. Drugi del študije je bil izveden na 60 pacientih, ki so bili napoteni na rentgensko slikanje medenice stoje. Naključno so bili razdeljeni v dve skupini z enakim številom. Polovica jih je umaknila tkivo s področja slikanja, druga polovica pa ne. Pri vseh smo izmerili obseg pasu in bokov, telesno višino in maso, DAP, velikost polja, razdaljo med goriščem in objektom slikanja, tokovni sunek (mAs) in napetost (kV). Naknadno smo iz meritev izračunali še indeks telesne mase, vstopno kožno dozo in efektivno dozo. Dobljene slike so ocenili trije radiologi.

Rezultati in razprava: Tanka trikotna ruta ni povzročala artefaktov na rentgenogramu. Obseg pasu se je zmanjšal za 4,7 % po umiku mehkega tkiva, medtem ko je obseg bokov ostal enak. V skupini pacientov, ki so umaknili maščobno tkivo med preiskavo, se je DAP znižal za 38,5 %, vstopna kožna doza za 44 %, efektivna doza pa za 38,7 %. Kolčna sklepa, veliki in mali grči stegnenice, sklepna ponvica kolčnega sklepa, vratova stegnenice, sredica in skorja kosti medenice, križnica in križnične odprtine ter mehka tkiva medenice in kolkov so bili bolj vidni na slikah z odmikom mehkega tkiva.

Zaključek: Z umikom maščobnega tkiva se znižajo DAP, vstopna kožna doza in efektivna doza, hkrati pa se izboljša kakovost slike.

Ključne besede: slikanje medenice stoje, odmik mehkega tkiva, kakovost slike, dozna obremenitev

ABSTRACT

Introduction and purpose: When previous studies compared erect pelvic imaging with the supine position, they reported lower image quality and higher radiation dose for erect pelvic X-ray in larger patients. The purpose of this study was to determine whether radiation dose and image quality differ for radiographs of the pelvis in the erect position with and without adipose tissue displacement.

Methods: The first part of the study was performed on a phantom in which we determined a band that would not produce artefacts on the resulting image when displacing fat tissue. The second part was performed on 60 patients who were randomly divided into two groups. One group had adipose tissue displaced from the pelvic region and the other did not. We measured waist and hip circumference, height, weight, DAP, primary field size, source-to-skin distance, mAs, and kV. We then calculated BMI, ESD, and effective dose. The images were evaluated by three radiologists.

Results and Discussion: A thin cotton triangular bandage showed no visible artefacts. Thickness around the waist decreased by 4.7% after tissue displacement, while hip circumference remained the same. In a group of patients with tissue displacement, DAP was 38.5% lower, ESD was 44% lower and effective dose was reduced by 38.7%. Hip joints, trochanters, acetabula, femoral necks, medulla and cortex of the pelvis, pelvic/hip soft tissues, and sacrum and its foramina were more visible on images obtained with fat tissue displacement.

Conclusion: When fat tissue was displaced from the pelvic region DAP, ESD and the effective dose decreased and the image quality increased.

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UPORABA KONTRASTNEGA SREDSTVA JODIKSANOL PRI CT PREISKAVAH BOLNIKOV S KARCINOMOM – PRIKAZ PRIMERA

USE OF CONTRAST MEDIUM IODIXANOL IN CT EXAMINATIONS OF CANCER PATIENTS - CASE STUDY

Hedvika Šauperl

Univerzitetni klinični center Maribor, Radiološki oddelek, Ljubljanska ulica 5, 2000 Maribor, Slovenija /
University medical centre Maribor, Department of Radiology, Ljubljanska ulica 5, 2000 Maribor, Slovenia

Korespondenca / Corresponding author: sauperl.hedvika@siol.net

Rak pljuč je drugo najpogostejše rakavo obolenje na svetu glede pojavnosti in najpogostejše glede smrtnosti. V Slovenji je po pogostnosti na tretjem mestu in za to boleznijo zboli okoli 1.400 ljudi letno. V zadnjih letih incidenca tega raka pri moških rahlo narašča, medtem ko pri ženskah močno narašča. Preživetje bolnika z rakom pluč je v največji meri odvisno od razširjenosti bolezni ob odkritju. Petletno preživetje bolnika z rakom pljuč je 10 do 15-odstotno.

Rentgenogram prsnih organov (RTG pc) je prva slikovna metoda pri kliničnem sumu na pljučnega raka. Če so na rentgenogramu prisotne radiološko sumljive spremembe, je treba opraviti dodatno slikovno diagnostiko, najprej računalniško tomografijo (CT) prsnega koša, ob pozitivnih najdbah pa še CT (in/ali MR) glave in CT zgornjega trebuha za oceno razširjenosti bolezni. Če po CT preiskavah ni znakov za širjenje bolezni zunaj prsnega koša, je treba pred odločitvijo o zdravljenju opraviti še pozitronsko emisijsko tomografijo s CT (PET-CT), s katero se zmanjša število nepotrebnih operativnih posegov, izbere optimalno mesto biopsije in (lahko tudi) nadomesti nekatere druge zamejitvene preiskave.

V UKC Maribor smo obravnavali 62-letno pacientko; zaradi suhega, dražečega kašlja jo je pulmolog napotil na slikanje pljuč, kjer je bila odkrita tumorozna zgostitev v 6. segmentu desnega spodnjega pljučnega režnja.

Gospa je bila napotena na dodatno slikovno diagnostiko za oceno razširjenosti bolezni:

- CT glave (nativno in s kontrastnim sredstvom (KS))
- CT prsnega koša (s KS-pozna faza po 70 s)
- CT trebuha (nativno zg. abdomen, arterijska faza zg. abdomen, pozna faza cel abdomen po 70 s).

CT je najpomembnejša preiskava za določanje stadija raka pljuč, t.i.»staging«:

- boljša senzitivnost in specifičnost
- pri večini bolnikov s pljučnim rakom (razen pri jasno razširjeni obliki)
- pred bronhoskopijo (senzitivnost)
- pred kirurškim zdravljenjem
- pred radikalnim obsevanjem
- spremljanje odgovora na kemoterapijo

Preiskave smo opravili na aparatu Siemens Somatom drive (model vb 20).

Pri preiskavi smo uporabili KS jodiksanol, koncentracije 320 mg I/ml, ki smo ga aplicirali z avtomatskim injektorjem CT motion (Ulrich medical). Intravenozno smo aplicirali 95 ml KS, s pretokom 3,5 ml/s.

Za vse ambulantne CT preiskave prsnega koša uporabljamo izoosmolarno KS jodiksanol.

Bolniki ob aplikaciji jodiksanola ne opisujejo izrazito neprijetnih občutkov, kar dokazuje tudi študija, v kateri so bolniki, ki so prejeli jodiksanol, imeli bistveno manjše zmerno do hudo nelagodje kot bolniki, ki so prejeli jopamidol.

Intenzivnost opacifikacije v žilju je sicer nižja, vendar za radiologa ni moteča. Nižja koncentracija joda v KS bo še pomembnejša, ko bomo pričeli z kvantifikacijo perfuzije tkiv.

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IMETNIK DOVOLJENJA ZA PROMET Z ZDRAVILOM:
GE Healthcare AS, P.O. Box 4220 Nydalen, NO-0401 Oslo, Norveška

VELIKOST PAKIRANJA:
10 polipropilenskih vsebnikov po 50 ml, 100 ml ali 200 ml. 6 polipropilenskih vsebnikov po 500 ml.

NAČIN IN REŽIM IZDAJE:
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DATUM PRIPRAVE INFORMACIJ:
julij 2021.

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Pot k sejmišču 35,
1231 Ljubljana-Črnuče
T: +386 1 23 55 100
E: slovenia.info@swixxbiopharma.com
Datum priprave: 03/2022

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OPTIMIZACIJA SPECT/CT IN PET/CT PROTOKOLOV

OPTIMIZATION OF SPECT/CT AND PET/CT PROTOCOLS

Sebastijan Rep , Slodnjak Ivan

Univerzitetni klinični center Ljubljana, Klinika za nuklearno medicino, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Clinic of nuclear medicine, Zaloška cesta 7, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: sebastijan.rep@guest.arnes.si

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IZVLEČEK

Uvod: Tomografski metodi slikanja v nuklearni medicini sta enofotonska emisijska računalniška tomografija (SPECT) in pozitronska emisijska tomografija (PET). Obe metodi prikažeta razporeditev radiofarmaka (RF) v telesu v treh ravninah. Pri prehodu fotonov skozi homogeno telo se prikaže neenakomerna razporeditev RF zaradi atenuacije. Računalniška tomografija (CT) v kombinaciji s funkcionalnimi metodami slikanja (SPECT/CT in PET/CT) korigira problem atenuacije fotonov. Slika, dobljena pri SPECT/CT in PET/CT, se lahko optimizira z uporabo CT za korekcijo atenuacije in fuzijo ter z rekonstrukcijskimi algoritmi, ki vključujejo korekcijo ločljivosti.

Namen: Namen opravljene raziskave je kvalitativno in kvantitativno oceniti in analizirati PET/CT in SPECT/CT slike z namenom optimizacije protokolov.

Metode: Uporabili smo NEMA body fantom in ga napolnili z 99mTc in 18F FDG v različnih razmerjih. Analizirali smo kontrastnost za SPECT/CT pri različnih rekonstrukcijskih algoritmih. Na PET/CT smo analizirali CNR (razmerje kontrast/šum) in CRC (koeficient vrnitve kontrasta) pri različnih matrikah. Primerjali smo tudi CNR med PET/CT in SPECT/CT. Za analizo smo uporabili programsko orodje SPSS 21.

Rezultati: Analiza kontrastnosti je pokazala statistično pomembno razliko med različnimi rekonstrukcijskimi algoritmi pri SPECT/CT ($p < 0{,}001$). Pri uporabi manjših matričnih elementov se CNR in CRC pri PET/CT povišata pri lezijah s premerom ≤ 1,21 cm do 11 %. Primerjava CNR za PET/CT in SPECT/CT je pokazala signifikantno razliko med obema metodama ($p = 0{,}002$). Pri obeh metodah se vrednost SNR viša glede na višino razmerja in kaže dobro korelacijo ($r = 0{,}85$ in $p < 0{,}001$).

Zaključek: Rezultati analize so potrdili, da se z optimizacijo slikovnih in obdelovalnih parametrov lahko vpliva na SPECT/CT in PET/CT slike.

Ključne besede: kontrastnost, SNR, CNR, SPECT/CT, PET/CT

ABSTRACT

Introduction: Tomographic imaging methods in nuclear medicine are single-photon emission computed tomography (SPECT) and positron emission tomography (PET). Both methods show the distribution of radiopharmaceuticals (RF) in the body in three planes. In the transition of photons through a homogeneous body, uneven distribution of RF due to attenuation appears. Computed tomography (CT) combined with functional imaging methods (SPECT/CT and PET/CT) corrects the problem of photon attenuation. The image obtained with SPECT/CT and PET/CT can be optimized by using CT for attenuation and fusion correction and reconstruction algorithms involving resolution correction.

Purpose: The purpose of the study is to qualitatively and quantitatively evaluate and analyze PET/CT and SPECT/CT images in order to optimize protocols.

Methods: We used a NEMA body phantom and filled it with 99mTc and 18F-FDG in different ratio. Contrast for SPECT/CT was analyzed for different reconstruction algorithms. CNR (contrast/noise ratio) and CRC (contrast return coefficient) for different matrices were analyzed on PET/CT. We also compared CNR between PET/CT and SPECT/CT. The SPSS 21 software tool was used for analysis.

Results: Analysis of contrastness showed a statistically significant difference between the different reconstructive algorithms in SPECT/CT ($p < 0.001$). When smaller matrix elements are used, CNR and CRC for PET/CT are increased for lesions ≤ 1.21 cm to 11% in diameter. The CNR comparison for PET/CT and SPECT/CT showed a significant difference between the two methods ($p = 0.002$). In both methods, the SNR value increases with respect to ratio height and shows a good correlation ($r = 0.85$ and $p < 0.001$).

Conclusion: The results of the analysis confirmed that SPECT/CT and PET/CT images can be affected by the optimization of the imaging and processing parameters.

Keywords: contrast, SNR, CNR, SPECT/CT, PET/CT

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KARTIRANJE RELAKSACIJSKEGA ČASA T_2 KOT ORODJE ZA OCENO ZOBNE PULPE

T_2 MAPPING AS A TOOL FOR ASSESSMENT OF DENTAL PULP

Ksenija Cankar[1], Jernej Vidmar[1,2,3], Lidija Nemeth[3], Igor Serša[1,4]

[1] Univerza v Ljubljani, Medicinska fakulteta, Inštitut za fiziologijo, 1000 Ljubljana, Slovenija / University of Ljubljana, Medical Faculty, Institute of Physiology, Zaloška cesta 4, 1000 Ljubljana, Slovenia

[2] Univezitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

[3] Univerza v Ljubljani, Medicinska fakulteta, Katedra za zobne bolezni in normalno morfologijo zobnega organa, Zaloška cesta 4, 1000 Ljubljana, Slovenija / University of Ljubljana, Medical Faculty, Department of Dental Diseases and Normal Dental Morphology, Zaloška cesta 4, 1000 Ljubljana, Slovenia

[4] Inštitut Jožef Stefan, Jamova cesta 39, 1000 Ljubljana, Slovenija / Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: ksenija.cankar@mf.uni-lj.si

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IZVLEČEK

Uvod: Standardna klinična diagnostika odziva zobne pulpe na napredovanje kariesa trenutno poteka na osnovi posredne ocene, saj temelji na osnovi kliničnih simptomov, ki so subjektivni in precej odvisni od bolnikove dovzetnosti za prag bolečine. Dodatno oceno omogočajo tudi klasične filmske in digitalne radiografske tehnike ter računalniška tomografija z usmerjenim snopom (CBCT), ki pa sicer podajajo le informacije o trdih zobnih tkivih. Nasprotno MRI omogoča tudi jasen prikaz zobne pulpe.

Namen: S študijo smo želeli preveriti, ali je mogoče v pogojih in vivo metodo kartiranja relaksacijskega časa T_2, ki je bila generirana na osnovi standardnih MRI zaporedij in na standardnem kliničnem MRI sistemu, uporabiti za kvantitativno oceno odziva zobne pulpe na napredovanje kariesa.

Metode: V študijo smo vključili 74 zob, izmerjenih na sistemu MRI 3T (Philips Achieva) in ocenili karies. Iz izračunanih map relaksacijskega časa T_2 smo analizirali T_2 profile vzdolž posameznih koreninskih kanalov (od krone do vrha), profili pa so bili razvrščeni glede na vrsto zob (enokoreninski oz. večkoreninski) in oceno napredovanja kariesa.

Rezultati: Pri vseh zobnih pulpah, ki so bile vključene v študijo, smo opazili znižanje vrednosti relaksacijskega časa T_2 z napredovanjem kariesa. V enokoreninskih zobeh je bilo znižanje vrednosti T_2 približno konstantno glede na globino prizadetosti zobne pulpe, pri večkoreninskih zobeh pa smo opazili v kronskem delu zvišane, proti koreninskemu delu pa znižane vrednosti T_2.

Zaključek: Uporaba in vivo MRI na osnovi standardnih MRI zaporedij dokazuje, da je z metodo kartiranja relaksacijskega časa T_2 možno podati zanesljivo kvantitativno oceno odziva zobne pulpe na napredovanje kariesa.

Ključne besede: zobna pulpa; karies; Kartiranje relaksacijskega časa T_2

ABSTRACT

Introduction: Currently, standard clinical diagnostics of dental pulp response to caries progression relies on indirect evaluation based on clinical symptoms that are subjective and highly influenced by patients' threshold for pain. In addition, film-based or digital conventional radiographic techniques and cone beam computed tomography (CBCT) provide information on hard dental tissues only. In contrast, MRI enables clear visualization of dental pulp.

Purpose: This study tested whether *in vivo* MRI based on standard MRI sequences run on a standard clinical MRI system can be used to quantify dental pulp response to caries progression using the T_2 mapping method.

Methods: In the study, 74 teeth were scanned on a 3T MRI system and caries was assessed. The T_2 maps were processed to obtain T_2 profiles along selected root canals (from crown to apex), and the profiles were sorted according to both tooth type (single-rooted vs. multi-rooted) and caries progression score.

Results: In all the examined dental pulps it was found that T_2 values decrease with caries progression. In single-rooted teeth, T_2 values were found approximately constant as a function of dental pulp depth, while in multi-rooted teeth, they were found to be increasing in the coronal part and decreasing towards the root apex.

Conclusion: In vivo MRI based on standard MRI sequences run on a standard clinical MRI system confirms that T_2 mapping of dental pulp can be used to reliably quantify its response to caries progression and that it has the potential to become a complementary diagnostic tool.

Keywords: dental pulp; caries; T_2 mapping

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MAGNETNO RESONANČNA VARNOST IN OBRAVNAVA PACIENTOV S VSTAVLJENIMI KARDIOVASKULARNIMI ELEKTRONSKIMI NAPRAVAMI: PREGLED NAJNOVEJŠE LITERATURE IN ŠTUDIJA PRIMERA

MRI SAFETY AND MANAGEMENT OF PATIENTS WITH CARDIOVASCULAR IMPLANTABLE ELECTRONIC DEVICES: LITERATURE REVIEW AND CASE PRESENTATION

Matic Godec, Jani Izlakar, Gašper Podobnik

Onkološki inštitut Ljubljana, Zaloška cesta 2, 1000 Ljubljana, Slovenija /
Institute of Oncology Ljubljana, Zaloška cesta 2, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: matic.godec@gmail.com

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Uvod: Magnetna resonanca je dolgo časa veljala za absolutno kontraindikacijo pri MR preiskavah pacientov z vstavljenimi CIED napravami. Tehnološki napredek na področju razvoja CIED naprav je doprinesel k uveljavitvi MR pogojno varnih kardiovaskularnih elektronskih naprav v kliničnem okolju. MR pogojno varne CIED naprave ne predstavljajo kliničnega tveganja za paciente s tovrstnimi napravami, če so upoštevani specifični pogoji uporabe. Varna izvedba MR slikanja je postala ključnega pomena pri zdravljenju tovrstnih pacientov.

Namen: Namen te raziskave je predstaviti pregled področja obravnave pacienta z vstavljeno CIED napravo med MR slikanjem in predstaviti primer MR slikanja prostate pri pacientu s CIED napravo.

Metode: V študiji smo predstavili obsežen pregled literature na področju MR varnosti in obravnave pacientov z vstavljenimi CIED napravami. Predstavili smo tudi primer obravnave MR slikanja prostate pri pacientu s CIED napravo. Literaturo smo zbirali s pomočjo elektronskih podatkovnih baz PubMed, Cinahl, Wiley Online Library in ScienceDirect.

Rezultati in razprava: Preiskavo smo izvedli v skladu s priporočili, predstavljenimi v tem dokumentu. MR status naprave smo ugotovili na podlagi pregleda identifikacijske kartice naprave in proizvajalčevih priporočil o uporabi naprave v MR okolju. Preiskava je bila opravljena brez kliničnih zapletov. Na MR slikah ni bilo prisotnih popačenj zaradi prisotnosti CIED naprave.

Zaključek: Najnovejše klinične študije in izdana priporočila ugotavljajo, da je MR slikanje pacientov s CIED napravami relativno varno v specifičnih pogojih, ne glede na to, ali gre za MR pogojno varne naprave ali ne. Ključnega pomena pri zagotavljanju varnosti pri MR preiskavah tovrstnih pacientov je predhodno multidisciplinarno načrtovanje preiskave, natančen varnostni pregled oz. screening pacienta, kakovosten nadzor nad pacientom med preiskavo in ocena delovanja naprave po preiskavi.

Ključne besede: magnetno resonančno slikanje, varnost, srčno žilne elektronske naprave

ABSTRACT

Introduction: MRI has long been contraindicated in patients with CIED devices due to the risk of adverse effects through electromagnetic interference. Recent developments in engineering have led to the introduction of the MRI Conditional CIED devices that do not cause significant clinical harm to patients undergoing MRI, when specific imaging conditions are met. Safe access to MRI has become a crucial need for patients with CIED devices.

Purpose: The purpose of this paper is to present an overview of managing patients with implanted CIED devices and to present a case report of a patient with CIED undergoing prostate MRI examination.

Methods: This paper explores the MRI safety and management of patients with implanted CIED devices through an extensive literature review and case presentation. The literature search was conducted using medical scientific electronic databases such as PubMed, Cinahl, Wiley Online Library and ScienceDirect. We examined a patient with CIED device undergoing prostate MRI examination.

Results and discussion: We performed the examination of the described patient in accordance with the guidelines presented in this paper. MR conditionality status was determined using device identification card and manufacturers technical manual. The MRI examination of the patient was completed without complications, therefore; no adverse effects were reported. MRI images were without artefacts.

Conclusion: Recent clinical studies and published guidelines suggest that MRI of the patients with either MRI conditional or MRI non-conditional CIED device is relatively safe under specific conditions. Multidisciplinary pre-procedure planning, strict screening process, monitoring and device evaluation protocols are of key importance for ensuring safe MRI imaging in patients with CIED.

Keywords: magnetic resonance imaging, safety, cardiovascular electronic devices

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MR STRES PERFUZIJA SRCA V UKC MARIBOR

MR CARDIAC STRESS PERFUSION AT THE UKC MARIBOR

Benjamin Švec, Teja Štih

Univerzitetni klinični center Maribor, Radiološki oddelek, Ljubljanska ulica 5, 2000 Maribor, Slovenija /
University medical centre Maribor, Department of Radiology, Ljubljanska ulica 5, 2000 Maribor, Slovenia

Korespondenca / Corresponding author: bsvec12@gmail.com

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IZVLEČEK

Uvod in namen: Namen prispevka je predstaviti protokol MR (angl. magnetic resonance) stres perfuzijo srca in opisati pomembnost preiskave pri pacientih z obolenji koronarnega ožilja. MR stresna perfuzija srca je neinvazivna slikovna metoda, s katero natančno ocenimo miokard, saj lahko dobro ločimo ishemične in neishemične spremembe na srčni mišici.

Metode: Pri 42-letnem pacientu z bolečinami v prsnem košu in mejno pozitivnim izvidom obremenitvenega testiranja pri kardiologu smo izvedli MR stres perfuzijo srca. Po opravljeni MR stres perfuzijski preiskavi srca so pacientu izvedli še koronarografijo z vstavitvijo stenta v RCA (angl. right coronary artery). Magnetno-resonančno preiskavo srca smo opravili na MR aparatu Siemens Magnetom Sola 1,5 T. Za obremenitev srca med preiskavo smo uporabili zdravilo Regadenoson (Rapiscan), ki ga apliciramo v veno.

Rezultati: Koronarografska preiskava je pokazala 96-odstotno stenozo RCA proksimalno. Stresna perfuzija je bila pozitivna, saj so bili prisotni perfuzijski defekti v celotni spodnji steni miokarda tako med obremenitvijo srca kot v mirovanju in na slikah poznega barvanja (angl. late gadolinium enhacement – LGE).

Zaključek: V univerzitetnem kliničnem centru Maribor je stres perfuzija srca pogosta in pomembna preiskava pri zdravljenju in obravnavi pacientov, ki imajo težave s koronarnimi obolenji.

Ključne besede: magnetna resonanca, stres perfuzija, regadenoson, adenozin, koronarna bolezen srca.

ABSTRACT

Introduction and purpose: The purpose of this article is to present the magnetic resonance (MR) protocol of cardiac perfusion and to describe the importance of the study in patients with coronary artery disease. MR Stress perfusion of the heart is a noninvasive imaging modality that accurately assesses the myocardium because we can discriminate well between ischemic and nonischemic changes in the myocardium.

Methods: In a 42-year-old patient with chest pain and a borderline positive stress test by a cardiologist, we performed MR stress perfusion of the heart. After MR stress perfusion of the heart, the patient underwent coronary angiography, during which a stent was placed in the RCA (right coronary artery). Magnetic resonance imaging of the heart was performed on a Siemens Magnet Sola 1.5 T MR machine. To stress the heart during the examination, we used Regadenoson (Rapiscan) administered intravenously.

Results: Coronary angiographic examination showed 96% RCA stenosis proximally. Stress perfusion was positive, as perfusion defects were seen throughout the inferior myocardial wall during cardiac stress as well as at rest and in late gadolinium enhancement (LGE) images.

Conclusions: At the University Medical Centre Maribor, cardiac stress perfusion is common and an important investigation in the treatment and care of patients with coronary artery disease problems.

Keywords: magnetic resonance imaging, stress perfusion, regadenoson, adenosine, coronary artery disease.

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T1 IN T2 MAPIRANJE PRI MAGNETNORESONANČNEM SLIKANJU SRCA

T1 AND T2 MAPPING IN MAGNETIC RESONANCE IMAGING OF THE HEART

Laura Šubej [1], Andrej Breznik [1], Boris Turk [1], Nejc Mekiš [2]

[1] Splošna Bolnišnica Celje, Radiološki oddelek, Oblakova ulica 5, 3000 Celje, 1000 Slovenija / General Hospital Celje, Department of Radiology, Oblakova ulica 5, 3000 Celje, 1000 Slovenia

[2] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical Imaging and Radiotherapy Department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: laura.subej@sb-celje.si

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Uvod: Magnetnoresonančno slikanje srca predstavlja največjo prednost za tridimenzionalen prikaz struktur z odlično prostorsko in visokokontrastno ločljivostjo. Tako se omogoča merjenje srčne funkcije in ocena morfoloških struktur. Napredek tehnologije ponuja možnost slikanja s T1 in T2 mapiranjem.

Namen: Ugotoviti nativne vrednosti T1 in T2 mapiranja pri zdravih preiskovancih ter ugotoviti vpliv preiskovalnega polja na vrednosti T1 in T2 relaksacijskega časa pri izvajanju T1 in T2 mapiranja.

Metode: V raziskavo je bilo vključenih 30 zdravih prostovoljcev. Raziskava je potekala na MR aparatu znamke Siemens Magnetom Aera 1.5 T. Vsakemu prostovoljcu smo opravili nativno T1 in T2 mapiranje srčne mišice. Izvedli smo korekcijo velikosti FOV, tako da smo velikost povečevali za 10 mm, in sicer od 360 mm do 390 mm. V drugem delu raziskave pa smo v računalniški program vrisovali interesna področja v interventrikularni septum ter primerjali meritve.

Rezultati: Primerjava velikosti slikovnega polja je pokazala, da obstajajo minimalne statistične razlike v vrednosti T1 relaksacijskih časov. Vse izmerjene vrednosti so v okvirih referenčnih vrednosti. Primerjava med velikostjo slikovnega polja pri T2 mapiranju je pokazala, da ne obstajajo statistično značilne razlike v T2 relaksacijskih časih. Vse izmerjene in izračunane vrednosti so v okvirnih referenčnih vrednostih T2 relaksacijskih časov. Med raziskavo smo ugotovili, da obstajajo razlike med spoloma tako pri T1 kot tudi T2 mapiranju.

Razprava in zaključek: Ugotovili smo, da so povprečne nativne vrednosti T1 in T2 mapiranja primerljive z rezultati drugih raziskav in z referenčnimi vrednostmi zdravega miokarda. V drugem delu raziskave smo ugotavljali, ali velikost slikovnega polja vpliva na izmerjene vrednosti T1 in T2 mapiranja pri MR slikanju srca. Ugotovili smo, da obstajajo posamezne minimalne razlike med vrednostmi T1 in T2 relaksacijskih časov, vendar še vedno v okviru normalnih vrednosti.

Ključne besede: MR slikanje srca, T1 mapiranje, T2 mapiranje

ABSTRACT

Introduction: Magnetic resonance imaging of the heart is used worldwide today in the field related to cardiovascular disease. The biggest advantage of magnetic resonance imaging of the heart is the three-dimensional display of structures with excellent spatial and high contrast resolution. It enables the measurement of cardiac function and the assessment of morphological structures. Advances in technology have made imaging possible with T1 and T2 mapping.

Purpose: To determine the native values of T1 and T2 mapping in healthy subjects and to determine the influence of the test field on the values of T1 and T2 relaxation time when performing T1 and T2 mapping.

Methods: 30 healthy volunteers were included in the study. The study was performed on a Siemens Magnetom Aera 1.5 T MR. None of the volunteers had a known history of cardiovascular disease or risk factors. For each volunteer, we performed native T1 and T2 mapping of the heart muscle at different image field sizes. We performed a size correction of the FOV by increasing the size by 10 mm, from 360 mm to 390 mm. In the second part of the research, we plotted areas of interest in the interventricular septum in a computer program and recorded measurements.

Results: A comparison between image field sizes in T1 mapping showed that there were minimal statistical differences in the values of T1 relaxation times. All measured and calculated values were within the reference values of T1 relaxation times. A comparison between the image field sizes in T2 mapping showed that there were no statistically significant differences in the values of T2 relaxation times. All measured and calculated values were in the approximate reference values T2 of relaxation times. The research has found gender differences in both T1 and T2 mapping.

Discussion and conclusion: We found that the average native values of T1 and T2 mapping are comparable with the results of other studies and that they can be compared with the native reference values of a healthy myocardium. In the second part of the study, we investigated whether the size of the image field affects the measured values of T1 and T2

mapping in MR imaging of the heart. We found that there are individual minimal differences between the calculated values of T1 and T2 relaxation times, but the measured values are still within normal values.

Keywords: MR imaging of heart, T1 mapping, T2 mapping

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PRIMERJAVA 1.5T IN 3T MAGNETNE RESONANCE V DIAGNOSTIKI KOLENA

COMPARING 1.5T AND 3T MAGNETIC RESONANCE IN KNEE DIAGNOSTICS

Barbara Juratović [1], Krešimir Dolić [2]

[1] Splošna bolnišnica »Dr. Tomislav Bardek« Koprivnica, Ulica Željka Selingera 1, 48000 Koprivnica, Hrvaška / General Hospital „Dr. Tomislav Bardek" Koprivnica, Ulica Željka Selingera 1, 48000 Koprivnica, Croatia

[2] Univerzitetni klinični center Split, Spinčićeva ulica 1, 21000 Split, Hrvaška / University Hospital Centre Split, Spinčićeva ulica 1, 21000 Split, Croatia

Korespondenca / Corresponding author: b.juratovich@gmail.com

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IZVLEČEK

Uvod in namen: Namen te študije je predstaviti preiskavo MRI kolena v klinični praksi z uporabo MR aparatov jakosti 1,5T in 3T. Ta izvleček temelji na iskanju znanstvene literature, objavljene na platformi Pubmed od leta 2009 do 2021.

Metode: Protokoli slikanja kolena običajno trajajo 20–40 minut, odvisno od slikovnega polja, patologije, števila sekvenc in debeline rezine. Protokol hitrega slikanja kolen na aparatu MR 3T lahko traja 10 minut, hkrati pa zagotavlja visokokakovostne slike. Glede na ESSR so protokoli za slikanje kolena sestavljeni iz T2 TSE FS ali PD FS sekvenc in T1 v koronarni, aksialni in sagitalni ravnini ter T2 aksialni poševnini za oceno ACL.

Rezultati: Vključenih je bilo 563 študij. Po uporabi meril za izključitev je bilo izbranih 16 kliničnih študij za analizo diagnostične natančnosti 1,5T in 3T MRI za poškodbe kolenskega sklepa, hrustanca, vezi in meniskusa. V vseh študijah je bila artroskopija referenčni standard. Za lezije sklepnega hrustanca se je AUC za 1,5T MRI bistveno razlikovala od 3T MRI (Z = 3,4, P < ,05). Za lezije znotraj ligamentov in meniskusa se vrednosti AUC za 1,5T MRI niso bistveno razlikovale od tistih za 3T MRI (Z = 0,32; P > ,05 in Z = 0,33; P > ,05).

Zaključek: Rezultati kažejo, da tako 1,5T kot 3T MRI nudita visoko diagnostično natančnost pri poškodbah kolena, ki vključujejo poškodbo meniskusov ali ligamentov. 3T MRI ponuja večjo diagnostično natančnost kot 1,5T MRI za lezije sklepnega hrustanca.

Ključne besede: 1.5T in 3T, MRI, koleno

ABSTRACT

Introduction and purpose: The aim of this study is to present the use of 1.5T and 3T knee MRI in everyday clinical practice. This abstract is based on a search of the scientific literature published on the Pubmed platform from 2009 to 2021.

Methods: Knee imaging protocols usually take 20–40 minutes, depending on the imaging field, pathology, number of sequences and slice thickness. Fast knee imaging protocol on 3T MRI can last 10 minutes while providing high quality images. According to ESSR knee imaging protocols consist of T2 TSE FS or proton density FS sequences and T1 sequences in coronal, axial and sagital plane and T2 axial oblique for ACL evaluation.

Results: The initial search included 563 studies. After applying exclusion criteria, 16 clinical studies were selected to analyze the diagnostic accuracy od 1.5T and 3T MRI for lesions of the knee joint, cartilage, ligaments and meniscus. In all studies, arthroscopy was the reference standard. For lesions within the articular cartilage, the AUC for 1.5T MRI differed significantly from 3T MRI (Z=3.4, P<.05). For lesions within the ligaments and meniscus, the AUC values for 1.5T MRI did not differ significantly from those for 3T MRI (Z=0.32, P>.05, and Z=0.33, P>.05, respectively).

Conclusion: Results indicate that both 1.5T and 3T MRI offer high diagnostic accuracy and clinical relevance for knee injuries involving the meniscus or a ligament. However, the present meta-analysis indicates that 3T MRI offers greater diagnostic accuracy than 1.5T MRI for articular cartilage lesions.

Keywords: 1.5T and 3T, MRI, knee

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MRCP S PROSTO DOSTOPNIMI NEGATIVNIMI KONTRASTNIMI SREDSTVI

MRCP WITH THE USE OF OVER-THE-COUNTER NEGATIVE CONTRAST AGENTS

Teja Aškerc [1], Nejc Mekiš [2], Andrej Breznik [1]

[1] Splošna Bolnišnica Celje, Radiološki oddelek, Oblakova ulica 5, 3000 Celje, 1000 Slovenija / General Hospital Celje, Department of Radiology, Oblakova ulica 5, 3000 Celje, 1000 Slovenia

[2] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical Imaging and Radiotherapy Department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: askerc.teja@gmail.com

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IZVLEČEK

Uvod: Magnetno resonančna holangiopankreatografija (MRCP) je neinvazivna slikovna diagnostika, namenjena prikazovanju biliarnega trakta in pankreatičnih vodov. Alternativa dragim in slabo dostopnim suspenzijam superparamagnetnih delcev so sokovi, ki vsebujejo višje koncentracije mangana, kot so borovničev sok, ananasov sok, sok acai jagod in črni čaj.

Namen: Zanimalo nas je, ali obstaja razlika v kakovosti slike med nativno sliko in po zaužitju različnih negativnih kontrastnih sredstev, ter katero od področij PBT je najbolje vidno po uporabi negativnih kontrastnih sredstev.

Metode: V raziskavo smo vključili 20 zdravih prostovoljcev in prostovoljk. Slike smo primerjali z nativno sliko, ki je bila narejena isti dan kot slika z izbranim negativnim kontrastnim sredstvom. Preiskovanci so posamično zaužili tri različna negativna kontrastna sredstva (ananasov sok, borovničev sok in črni čaj). Med uporabo posamičnih kontrastnih sredstev je moralo preteči vsaj 24 ur. Nativni fazi je sledila druga faza z uporabo negativnega kontrastnega sredstva 10 minut po zaužitju le-tega. Slike sta ocenila dva izkušena radiologa, ki sta na slikah ocenjevala kakovost slik po zaužitju negativnega kontrastnega sredstva.

Rezultati in razprava: Ugotovili smo, da se pri uporabi vseh vrst negativnih kontrastnih sredstev nakazuje podoben trend vidljivosti anatomskih struktur. Najboljše rezultate oz. kakovost slik smo dosegli z uporabo ananasovega soka. Ugotovili smo statistično značilne razlike v kakovosti izničenja signala iz želodca, dvanajstnika, trebušne slinavke, žolčnih vodov in papile Vateri. Pri uporabi črnega čaja nismo ugotovili statistično značilnih razlik.

Zaključek: Na slikah, ki so nastale po zaužitju ananasovega ali borovničevega soka, je v primerjavi z nativno sliko bolj jasno vidno, da je učinkovito in signal iz želodca, dvanajstnika ter proksimalnega dela črevesja zasičen. Črni čaj je dobil najslabše ocene, ker se nobena od opazovanih anatomskih struktur na sliki po zaužitem kontrastnem sredstvu ni videla bolje.

Ključne besede: MRCP, negativno kontrastno sredstvo, ananasov sok, borovničev sok, črni čaj, vizualizacija

ABSTRACT

Introduction: Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive MR examination technique that provides us with information about the anatomy and pathology of the bile ducts. Alternatives to expensive negative contrast agents are over-the-counter beverages that contain higher concentrations of manganese, such as blueberry juice, pineapple juice, and black tea.

Purpose: To investigate whether the use of negative over-the-counter contrast agents improves the quality of MRCP examination, which of them provide better visualization of the pancreato-biliary tract (PBT), and in which areas of the PTB the greatest differences are seen.

Methods: Measurements were performed on 20 healthy volunteers. We started with »native« imaging of the PBT area, and at least 24-hour intervals, the volunteers ingested three different negative contrast agents such as pineapple juice, blueberry juice, and black tea. The examinations were repeated 10 minutes after ingestion of the contrast agents. Images were evaluated by two experienced radiologists who assessed the improvement in visualization after contrast ingestion.

Results: A comparison between pineapple juice and blueberry juice showed that there were no statistically significant differences between them, but pineapple juice had an insignificantly higher score compared with all anatomic structures. We found a statistically significant difference in signal suppression in the stomach, duodenum, pancreatic duct, common bile duct, and papillae Vateri after ingestion of pineapple juice and blueberry juice. Statistical analysis showed no significant differences after the consumption of black tea.

Discussion and Conclusion: We found that pineapple juice and blueberry juice were both equally suitable for performing MRCP examination, as they best suppressed the signal from the gastrointestinal tract and allowed better visualization of the PBT, whereas black tea proved to be an ineffective negative contrast agent.

Keywords: MRCP, negative contrast media, pineapple juice, blueberry juice, black tea, visualization

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GRADIENTNA TEHNIKA PRI OBSEVANJU KRANIOSPINALNEGA PODROČJA Z UPORABO VOLUMETRIČNE LOČNE TERAPIJE

SEGMENT GRADIENT BASED TECHNIQUE FOR CRANIOSPINAL IRRADIATION WITH VMAT

Matevž Mlekuž

Onkološki inštitut Ljubljana, Zaloška cesta 2, 1000 Ljubljana, Slovenija /
Institute of Oncology Ljubljana, Zaloška cesta 2, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: mmlekuz@onko-i.si

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IZVLEČEK

Uvod in namen: Namen prispevka je predstaviti prednosti volumetrično modulirane ločne terapije (VMAT, angl. volumetric modulated arc therapy) in uporabo gradientne tehnike (tj. tehnika, pri kateri ustvarimo postopno padajoč dozni profil žarkovnega snopa) pri obsevanju kraniospinalnega področja (CSI, angl. craniospinal irradiation). V nadaljevanju prispevka je predstavljeno tudi preverjanje kakovosti obsevalnega načrta pred obsevanjem (QA, angl. quality assurance).

Metode: Za namen raziskave sem izdelal osnoven obsevalni načrt VMAT s tremi izocentri. Vsakemu izmed izocentrov sem pripisal dva para prekrivajočih se ločnih žarkovnih snopov. Žarkovni snopi so zajeli področje glave in dve spinalni področji. Z namenom pridobitve postopno padajočega profila doze, sem v področju prekrivanja žarkovnih snopov ustvaril deset dodatnih segmentov oz. kontur znotraj planirno tarčnega volumna (angl. planning target volume). Vsa področja z ustreznimi žarkovnimi snopi sem ločeno dozno optimiziral. Najprej sem optimiziral področje glave in spodnji spinalni predel, naknadno pa še zgornje spinalno področje in pri tem upošteval dozno porazdelitev že optimiziranih predelov. Za ovrednotenje občutljivosti oz. robustnosti (angl. plan robustness) obsevalne tehnike na premike pri nastavitvi pacienta (angl. set up errors) sem simuliral ± 3,5 in 10 mm premike v longitudinalni smeri. Normalizirane dozne profile (% PDD) obsevalnih načrtov s simulacijo premika sem primerjal z osnovnim obsevalnim načrtom.

Ustreznost prvotnega obsevalnega načrta sem preveril s primerjavo načrtovane in izmerjene doze. Za analizo sem uporabil gamma kriterij (γ), (ang. Gamma index), z nastavitvami 3 % v dozi (DD, angl. dose difference) in 3 mm v oddaljenosti (DTA, angl. distance to agreement) med točkama primerjave.

Rezultati: Simulacija premikov pri nastavitvi pacienta ± 3, 5 in 10 mm v longitudinalni smeri rezultira v ≈ 6,7 in 16 % razliko v % PPD glede na osnoven obsevalni načrt. Pri analizi načrtovane in izmerjene doze je 98,8 % merjenih točk manjših od γ vrednosti 1.

Zaključek: Uporaba tehnike VMAT z gradientnim pristopom pri obsevanju kraniospinalnega področja omili dozimetričen učinek, ki nastane kot posledica napake pri nastavitvi pacienta. Analiza dozne porazdelitve kaže na ustrezno ujemanje izračunane in izmerjene doze.

Ključne besede: obsevanje kraniospinalnega področja, volumetrično modulirana ločna terapija, tehnika gradientnega pristopa, napake pri nastavitvi pacienta, robustnost

ABSTRACT

Introduction and purpose: To present advantages of volumetric modulated arc therapy technique (VMAT) with "segment gradient based approach" for craniospinal irradiation (CSI) and associated pre-treatment quality assurance procedure.

Methods: A three isocenter VMAT plan was designed. Each isocenter contained two pairs of overlapping partial arc fields that covered the cranial and two spinal parts. In the overlapping regions, an additional 10 segments were contoured in order to obtain a gradually decreasing dose profile. All parts (cranial and two spinal) with associated partial arc fields were optimized separately. Cranial and lower spinal parts were optimized first. Subsequently, upper spinal part was optimized by taking into account the dose contribution from previously optimized parts. To investigate plan insensitivity against the set up errors ± 3, 5, and 10 mm, longitudinal shifts were simulated. Normalized dose difference profiles (%PDD) with original plan were evaluated.

For plan verification phantom dose was calculated and compared with the measured dose. Analysis was performed using gamma index (γ) criteria with settings 3% of dose difference (DD) and 3mm of distance to agreement (DTA).

Results: Simulating set up errors ± 3, 5 and 10 mm in longitudinal direction % PPD versus the original plan, were ≈ 6,7 and 16%, respectively. Plan verification dose analysis revealed that 98.8% of measured points were within γ index<1.

Conclusion: The VMAT with "segment gradient based approach" for CSI has turned out to be a favorable technique in terms of its robustness to set up errors. Dose distribution analysis showed an appropriate calculated and measured dose matching.

Keywords: craniospinal irradiation, gradient based approach, set up errors, robustness

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TIPIČNE CT DOZE PRI PET/CT PREISKAVH V SLOVENIJI

TYPICAL ADULT CT DOSES OF PET-CT EXAMINATIONS IN SLOVENIA

Jelena Perić [1], Nejc Mekiš [2], Dejan Žontar [3,4]

[1] Onkološki Inštitut Ljubljana, Oddelek za nuklearno medicino, Zaloška cesta 2, 1000 Ljubljana, Slovenija / Institute of Oncology Ljubljana, Department of Nuclear Medicine, Zaloška cesta 2, 1000 Ljubljana, Slovenia

[2] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical imaging and radiotherapy department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

[3] Uprava Republike Slovenije za varstvo pred sevanji, Ajdovščina 4, 1000 Ljubljana, Slovenija / Slovenian Radiation Protection Administration, Ajdoviščina 4, 1000 Ljubljana, Slovenia

[4] Inštitut Jožef Stefan, Jamova cesta 39, 1000 Ljubljana, Slovenija / Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: jelena.peric13@gmail.com

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IZVLEČEK

Uvod: Hibridno slikanje, pri katerem pozitronsko emisijsko tomografijo (PET) združimo z računalniško tomografijo (CT), omogoča natančnejšo lokalizacijo in karakterizacijo bolezni, vendar pomembno poveča dozno obremenitev pacientov.

Namen: Namen raziskave je bil določiti tipične izpostavljenosti pacientov zaradi CT slikanja pri najpogostejših PET-CT protokolih v Sloveniji.

Metode: Na vseh treh PET-CT napravah v Sloveniji smo zbrali podatke za skupno 565 bolnikov, ki so v obdobju 11 mesecev opravili PET-CT preiskavo. Upoštevani so bili trije najpogostejši protokoli, ki obsegajo približno 2/3 vseh PET-CT preiskav, opravljenih v Sloveniji. Ker je število PET-CT naprav v Sloveniji prenizko za določitev nacionalnih DRL, smo sledili priporočilom ICRP in določili tipične vrednosti DRL količin kot mediane vrednosti združenega niza podatkov. Za vsako enoto smo določili povprečje, mediano in standardni odklon CT doznega indeksa ($CTDI_{vol}$) ter produkta doze in dolžine preiskovalnega polja (DLP) za CT del izbranih protokolov. Da bi opredelili možna izstopanja, smo izvedli tudi primerjavo tipičnih izpostavljenosti med enotami.

Rezultati: Ugotovljene tipične vrednosti skupnega DLP so 295 mGy·cm za PET/CT slikanje od baze lobanje do sredine stegnenic, 359 mGy·cm za PET/CT slikanje od vrha glave do sredine stegnenic in 676 mGy·cm za PET/CT slikanje od vrha glave do vključno prstov na nogah. Pripadajoče vrednosti $CTDI_{vol}$ so 3,05 mGy, 3,22 mGy oziroma 3,60 mGy.

Razprava in zaključek: Rezultati predstavljajo prve podatke o tipičnih vrednostih DRL količin za CT del najpogostejših PET-CT preiskav v Sloveniji. Primerjava podatkov med enotami je pokazala bistveno višje ($p < 0,001$) izpostavljenosti bolnikov v eni od enot, kar kaže na potrebo po optimizaciji.

Ključne besede: pozitronska emisijska tomografija – računalniška tomografija, računalniška tomografija, diagnostično referenčne ravni, doze, optimizacija

ABSTRACT

Introduction: Hybrid imaging, which combines positron emission tomography (PET) with computed tomography (CT), allows more accurate localization and characterization of the disease but significantly increases the dose load of patients.

Purpose: The purpose of the study was to determine the typical dose exposures of patients due to CT imaging in the most common PET-CT protocols in Slovenia.

Methods: Data on a total of 565 patients who underwent PET-CT examination over a period of 11 months were collected on all three PET-CT devices in Slovenia. The three most common protocols were taken into account, comprising approximately 2/3 of all PET-CT examinations performed in Slovenia. As the number of PET-CT devices in Slovenia is too low to determine national DRLs, we followed the ICRP recommendations and determined the typical values of DRL quantities as the median values of the combined data set. For each unit, we determined the mean, median, and standard deviation of the CT dose index ($CTDI_{vol}$) and the dose and length of the test field (DLP) product for the CT portion of the selected protocols. To identify possible deviations, we also performed a comparison of typical exposures between units.

Results: Typical total DLP values are 295 mGy · cm for PET / CT imaging from the base of the cranium to the middle of the femur, 359 mGy · cm for PET / CT imaging from the top of the head to the middle of the femur and 676 mGy · cm for PET / CT imaging from the top of the head up to and including the toes. The corresponding $CTDI_{vol}$ values are 3.05 mGy, 3.22 mGy and 3.60 mGy, respectively.

Discussion and conclusion: The results represent the first data on typical values of DRL quantities for CT as part of the most common PET-CT examinations in Slovenia. Comparison of data between units showed significantly higher ($p < 0.001$) patient exposures in one of the units, indicating the need for optimization.

Keywords: positron emission tomography – computed tomography, computed tomography, diagnostic reference levels, doses, optimization

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SPECIALNO SLIKANJE ZAPESTJA S STISNJENO PESTJO

SPECIAL X-RAY WRIST WITH CLENCHED FIST VIEW

Polona Bravhar

Univezitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: polonabravhar@gmail.com

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IZVLEČEK

Uvod: Roka je izjemno pomemben del telesa, saj z njo stvari premikamo, se jih dotikamo, z roko proizvajamo mišično silo, hkrati pa je senzorično-motorični nadzor gibanja roke zelo natančen. Poškodbe zapestja so relativno zelo pogoste, čeprav so nekatere poškodbe očitne, je potrebna natančna preiskava, da se odkrije tudi tiste druge, bolj subtilne poškodbe. Skafolunatna (S-L) nestabilnost je predvidena iz abnormalne pozicije ali čolnička ali lunice. Nastane pri močno pretiranem iztegu zapestja (dejansko upogib nazaj), ki preseže normalno sposobnost iztega kosti distalne zapestne vrste v srednjem zapestnem sklepu. Popolna poškodba je vidna le na stresnih rentgenskih slikah (stisnjena pest), diagnozo pa največkrat potrdimo z magnetno resonanco ali artroskopijo zapestja. Vedno primerjamo obe roki zaradi možne benigne kongenitalne variante širšega S-L prostora.

Namen: Predstavitev specialnega slikanja zapestja s stisnjeno pestjo na travmatološkem oddelku v UKC Ljubljana.

Metode: Na travmatološkem oddelku slikamo zapestja s stisnjeno pestjo v posteroanteriorni ter stranski lateromedialni projekciji. Pacient sedi na stolu ob preiskovalni mizi. Pri obeh projekcijah je nadlahet slikane roke ob telesu ter v komolcu v fleksiji za 90°. Slikano zapestje ima položeno na digitalnem detektorju. Pozicijsko je zapestje enako pozicionirano kot pri klasičnem slikanju zapestja. Med eksponiranjem pacient stisne pest, tako da se napnejo vse mišice slikanega zapestja. Ugotovili smo, da je pri PA projekciji pomembno, da je roka naslonjena na palec roke, tako da je ravnina med šiljastima odrastkoma koželjnice in podlahtnice vzporedna s podlago. Pacient mora dobro napeti mišice, saj se drugače patologija ne prikaže.

Rezultati: Zaradi poškodbe S-L vezi je razdalja med čolničkom in lunico povečana. Čolniček, ki ni več vezan na lunico, se zavrti z distalnim delom v palmarno smer, zato je njegova radiološka senca krajša od normalne. Ugotovili smo, da je pomembna pravilna pozicija zapestja ter dober stisk mišic, saj drugače hitro zakrijemo patologijo.

Zaključek: Po pregledu pacienta, se zdravnik travmatolog odloči za stresno slikanje zapestja s stisnjeno pestjo. Pomembno pri slikanju zapestja s stisnjeno pestjo je dobra komunikacija s pacientom, da razume pomen dobrega stiska mišic. Pomembno je hitro prepoznavanje ter zdravljenje poškodb zapestja, ki lahko vodijo v dolgotrajno obolevnost.

Ključne besede: RTG zapestja, stresno slikanje s stisnjeno pestjo, skafolunatna nestabilnost

ABSTRACT

Introduction: The hand is an extremely important part of the body, because we use to move things, touch them and produce muscular force. At the same time the sensory-motor control of the movement of the hand is very precise. Wrist injuries are relatively common. Although some injuries are obvious, careful investigation is needed to detect other, more subtle injuries as well. Scapholunate (S-L) instability is predicted from an abnormal position of either bone scaphoid or bone lunate. It occurs when the wrist is severely stretched (actually bending backwards), which exceeds the normal ability to stretch the bone of the distal wrist type in the middle wrist joint. Complete damage is visible only on stress X-rays (clenched fist), and the diagnosis is usually confirmed by magnetic resonance imaging or wrist arthroscopy. We always compare both wrists due to the possible benign congenital variant of the wider S-L space.

Purpose: Presentation of a special wrist painting with a clenched fist at the trauma department at the UKC Ljubljana.

Methods: At the polyclinic - traumatology department, wrists with clenched fists are imaged in posteroanterior and lateral (lateromedial) projection. The patient is sitting in a chair next to the examination table. In both projections, the arm is lowered along the body and in the elbow in flexion of 90°. The wrist is laid on a digital detector. In terms of position, the wrist is positioned in the same way as in classic wrist painting. During exposure, the patient clenches their fist so tight that all the muscles of the wrist are tense. We found that in PA projection, it is important that the hand rests on the thumb of the hand, so that the line between radius and ulna is parallel to the detector. The patient must tense the muscles well, otherwise the pathology will not show.

Results: Due to the injury of the S-L ligament, the distance between scaphoid and lunate is increased. Scaphoid, which is no longer tied to lunate, rotates with the distal part in the palmar direction, so its radiological shadow is shorter than normal. We found that the correct position of the wrist and good muscle compression are important, because otherwise we quickly cover up the pathology.

Conclusions: After examining the patient, the traumatologist decides to perform a stressful X-ray wrist with a clenched fist view. It is important when imaging a wrist with a clenched fist to communicate well with the patient to understand the importance of good muscle compression. It is important to quickly identify and treat wrist injuries, so this does not lead to long-term illness.

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PRIMERJAVA OBSEVANJA RAKA DOJK V ANTERO-POSTERIORNI IN POSTERO-ANTERIORNI SMERI

COMPARISON OF BREAST CANCER IRRADIATION IN SUPINE AND PRONE POSITIONS

Eva Imenšek [1], Iris Petruz [2], Sabina Androjna [1], Valerija Žager Marciuš [1,2]

[1] Onkološki inštitut Ljubljana, Oddelek za teleradioterapijo, Zaloška cesta 2, 1000 Ljubljana, Slovenija / Institute of Oncology Ljubljana, Department of Teleradiotherapy, Zaloška cesta 2, 1000 Ljubljana, Slovenia

[2] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical Imaging and Radiotherapy Department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: valerija.zager@zf.uni-lj.si

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IZVLEČEK

Uvod in namen: Obsevanje pri raku dojk se danes izvaja v antero-posteriornem (AP) kot tudi v postero-anteriornem (PA) položaju. Cilj raziskave je predstaviti, ali položaj obsevanja, starost bolnice in število frakcij obsevanja pomembno vplivajo na velikost interfrakcijskih premikov pri geometrični verifikaciji v lateralni, longitudinalni in vertikalni smeri.

Metode: Raziskava je bila zasnovana retrospektivno s sekundarno statistično analizo podatkov. Analiza o interfrakcijskih premikih se je izvedla pri 25 bolnicah, ki so obsevale raka dojk v AP položaju na podlagi Breastboard (CIVCO), in 25 bolnicah v PA položaju na podlagi Sagittilt (Orfit). Geometrična verifikacija je bila v vseh primerih izvedena v prostem dihanju pred obsevanjem. Pri obsevanju v AP položaju je bila uporabljena 2D/2D (2D – dvodimenzionalno) verifikacija kilovoltnih (kV) slik. Pri obsevanju raka dojk v PA položaju je bila uporabljena verifikacija s CBCT (angl. cone beam computed tomography, računalniška tomografija s stožčastim snopom). Verifikacijske slike so bile zajete s sistemom XVI (angl. X-ray volumetric imaging system).

Rezultati: Rezultati pri AP položaju so pokazali največje interfrakcijske premike v longitudinalni smeri, najmanjše pa v lateralni smeri. Z Mann-Whitney U testom smo dokazali statistično značilno razliko med lateralno in vertikalno ($p = 0,008$) ter med lateralno in longitudinalno smerjo ($p = 0,002$) v AP položaju. V PA položaju so bili največji premiki v lateralni, najmanjši pa v longitudinalni smeri. S Kruskal Wallis testom smo dokazali, da pri PA položaju obsevanja v lateralni, longitudinalni in vertikalni smeri ni statistično značilnih razlik med premiki ($p = 0,220$). Ugotovili smo, da je povprečje premikov v vseh treh smereh večje v PA položaju (Slika 1). Največja povprečna razlika med položajema obsevanja je v lateralni, najmanjša pa v longitudinalni smeri.

Neparametrični Mann-Whitney U test pokaže statistično značilne razlike v premikih v vseh treh smereh glede na položaj obsevanja ($p < 0,05$). Starost bolnic ($p > 0,05$) in število frakcij obsevanja ($p > 0,05$) nimata statistično značilnega vpliva na velikost premikov med AP in PA položajem obsevanja.

Zaključek: S primerjavo vpliva položaja obsevanja, starosti bolnic in številom frakcij obsevanja na velikost interfrakcijskih premikov pri geometrični verifikaciji z drugimi študijami, smo prišli do enakih ugotovitev. Pri vseh translacijskih premikih obstajajo statistično značilne razlike med obsevanjem v AP in obsevanjem v PA položaju ($p<0,05$), premiki so večji pri PA položaju obsevanja.

Ključne besede: obsevanje raka dojk, antero-posteriorni in postero-anteriorni položaj, interfrakcijski premiki

ABSTRACT

Introduction and purpose: Today radiation therapy for breast cancer is performed in both - supine and prone position. The aim of the study is to present if the patient position, age and the number of fractions of radiation, have a significant influence on the size of inter-fraction displacements during geometric verification in lateral, longitudinal and vertical directions.

Methods: The study was designed retrospectively with secondary statistical data analysis. The analysis of inter-fraction displacements was performed in 25 patients that underwent breast cancer irradiation in supine position (Breastboard, CIVCO) and 25 patients in prone position (Sagittilt, Orfit). All patients received radiation therapy with free-breathing geometric verification performed before the irradiation - 2D/2D (two-dimensional) kilovoltage (kV) image verification in supine and cone-beam computed tomography (CBCT) in prone position. The images used for verification purposes were captured using the X-ray Volumetric Imaging System (XVI).

Results: The results showed that, on average, the largest inter-fraction displacements in supine positioning are in the longitudinal direction and the smallest in the lateral direction. The Mann-Whitney U test showed a statistically significant difference between lateral and vertical displacements ($p=0.008$) and between lateral and longitudinal displacements ($p=0.002$) in supine positioning. The Kruskal-Wally's test showed that there were no statistically significant differences in the lateral, longitudinal and vertical directions in prone positioning ($p=0.220$).

The average displacements in all three directions are larger in prone position (Figure 1). The largest average difference between the two irradiation positions is in the lateral direction, while the smallest is in the longitudinal direction. The non-parametric Mann-Whitney U test shows statistically significant differences in the inter-fraction displacements in all three directions, depending on the patient's position ($p<0.05$). Patient age ($p>0.05$) and the number of fractions of radiation ($p>0.05$) do not have a statistically significant effect on the size of displacements between the supine and prone positions.

Conclusion: Comparing the influence of the patient's position during breast cancer irradiation, the age of the patients and the number of fractions of radiation on the size of the inter-fraction displacements in geometric verification with other studies, the same conclusions were reached. For all translational displacements, there are statistically significant differences between irradiation in the supine and prone position ($p<0.05$), with larger displacements in the prone position.

Keywords: breast cancer irradiation, supine and prone position, inter-fraction displacements

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TOČKOVNA ORIENTACIJA PRI RENTGENSKEM SLIKANJU PRSNIH ORGANOV V POSTERIO-ANTERIORNI PROJEKCIJI

ORIENTATION POINTS ON CHEST RADIOGRAMS IN POSTERIOR ANTERIOR PROJECTION

Sašo Muc [1]***, Nejc Mekiš*** [2]***, Igor Kocijančič*** [1]

[1] Univerzitetni klinični center Ljubljana, Klinični inštitut za radiologijo, Zaloška cesta 7, 1000 Ljubljana, Slovenija / University medical centre Ljubljana, Institute of Radiology, Zaloška cesta 7, 1000 Ljubljana, Slovenia

[2] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical Imaging and Radiotherapy Department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

Korespondenca / Corresponding author: muc.saso@gmail.com

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IZVLEČEK

Uvod: Standardno slikanje prsnih organov je najbolj pogosta preiskava v diagnostični radiologiji. Pri slikanju prsnih organov sevalno obremenimo večje področje človeškega telesa, zato je pomembna natančnost pri nastavljanju v izogib ponavljanju slikanja.

Namen: Namen magistrske raziskave je bil izboljšanje postavitev in zaslanjanje rentgenskega snopa s pomočjo orientacijskih točk na telesu. S tem zmanjšamo obsevalno polje in hkrati zmanjšamo število neuspelih rentgenogramov.

Metode: V raziskavi smo obravnavali 4 orientacijske točke in 6 tarčnih struktur. Na 2544 rentgenogramih prsnih organov v PA projekciji smo meritve neodvisno opravili trije radiološki inženirji. Beležili smo relativne položaje točk na rentgenogramih, ki smo jih kasneje pretvorili v relativne razdalje med njimi. Razdalje so bile popravljene za oddaljenost 5 cm od detektorja.

Rezultati: Relativni položaji točk in velika baza podatkov so nam omogočili širok nabor primerjave ter tudi pozicijo lege individualnih pljuč glede na skelet prsnega koša – to nam omogoča zaslanjanje in centriranje s pomočjo orientacijskih točk. V 95 odstotkih so se pljučni apeksi nahajali 1,2 cm pod trnom C7 in 3,1 cm nad AC sklepoma. Če želimo prikazati celotna pljuča z zadnjimi frenikokostalnimi sinusi, moramo centralni žarek nastaviti 3,5 cm kavdalno od trna Th7 oziroma za 1,1 cm kavdalno od trna Th7, če želimo prikazati pljuča do sprednjih frenikokostalnih sinusov. Širina pljuč skoraj vedno zahteva horizontalno lego slikovnega sprejemnika.

Razprava in zaključek: Večina literature omenja center slike pri Th7. Z raziskavo smo dokazali, da je optimalni center nižje. Prav tako smo bolje definirali optimalni rob slike oziroma velikost pljuč s pomočjo tipljivih orientacijskih točk.

Ključne besede: centriranje, prsni organi, orientacijske točke, Th7.

ABSTRACT

Introduction: Standard chest imaging is the most common examination in diagnostic radiology. When imaging the thoracic organs, a larger area of the human body is exposed to radiation, so accuracy in adjustment is important to avoid repeating the imaging.

Purpose: The purpose of this master's research was to improve the placement and screening of the X-ray beam with the help of orientation points on the body. This reduces the radiation field and at the same time reduces the number of failed radiographs.

Methods: In the research, we considered four orientation points and six target structures. Measurements were independently performed by three radiological engineers on 2,544 chest radiographs in the PA projection. We recorded the relative positions of the points on the radiographs, which we later converted into relative distances between those points. The distances were corrected by a distance of 5 cm from the detector.

Results: The relative positions of points and a large database provided us a wide range of comparisons, as well as the position of individual lungs relative to the skeleton of the chest. This, in turn, allowed us to screen and centre with the help of orientation points. In 95% of cases, the pulmonary apexes were located 1.2 cm below the C7 mandrel and 3.1 cm above the AC joints. To show the entire lung with the posterior phrenicocostal sinuses, the central beam must be adjusted 3.5 cm caudally from the Th7 mandrel or 1.1 cm caudally from the Th7 mandrel to show the lungs to the anterior phrenicocostal sinuses. The width of the lungs almost always requires the image receiver to be in a horizontal position.

Discussion and Conclusion: Most of the literature mentions the image centre at Th7. Through research, we have proven that the optimal centre is lower. We also better defined the optimal edge of the image or the size of the lungs with the help of tactile orientation points.

Keywords: cantering, thoracic organs, orientation points, Th7.

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PRIMERJAVA MED CYBER NOŽEM IN TOMOTERAPIJO V HOMOGENOSTI DOZE ZNOTRAJ PTV IN PRIZADETOSTJO REKTUMA PRI BOLNIKIH Z RAKOM PROSTATE

COMPARISON BETWEEN CYBERKNIFE AND TOMOTHERAPY IN DOSE HOMOGENEITY INSIDE PTV AND RECTAL SPARING IN PROSTATE CANCER PATIENTS

Lea Pogorevčnik [1]***, Anja Robida*** [1]***, Joyce Wittebrood*** [2]

[1] Univerza v Ljubljani, Zdravstvena fakulteta, Oddelek za radiološko tehnologijo, Zdravstvena pot 5, 1000 Ljubljana, Slovenija / University of Ljubljana, Faculty of health sciences, Medical imaging and radiotherapy department, Zdravstvena pot 5, 1000 Ljubljana, Slovenia

[2] Inholland University of Applied Sciences, Medical imaging and radiotherapeutic techniques department, Haarlem Bijdorplaan 15, 2015 CE Haarlem, Netherlands

Korespondenca / Corresponding author: lea.pogorevcnik@gmail.com

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IZVLEČEK

Uvod: Obstajajo različne tehnike obsevanja za zdravljenje bolnikov z rakom prostate, med katere spadata tudi zdravljenje s Cyber nožem (angl. Cyberknife, CK) in tomoterapijo (TT). CK je sistem 6-megavoltnega (MV) linearnega pospeševalnika na robotski roki in omogoča intrafrakcijsko premikanje ter sledenje tumorske tarče med obsevanjem. Zaradi te posebne lastnosti je zelo natančna tehnika zdravljenja z obsevanjem in omogoča dozimetrično ugodne rezultate za zdrave okoliške strukture, npr. rektum. Večina bolnišnic ne more zagotoviti zdravljenja s CK, zato se v takšnem primeru lahko odločijo za zdravljenje s TT. Zanjo je značilna posebna spiralna pot sevanja okoli bolnika, ki omogoča konformno porazdelitev doze ter večjo zaščito zdravega tkiva okoli tarče.

Namen: Namen prispevka je raziskati razlike v homogenosti porazdelitve doze v planirnem tarčnem volumnu (angl. planning target volume, PTV) in prizadetostjo rektuma po obsevanju bolnikov z rakom prostate med obsevalnima tehnikama CK in TT. Prav tako je namen seznaniti radiološke inženirje z omenjenima obsevalnima tehnikama, ki se uporabljata v tujini.

Metode dela: Za pisanje znanstvenega članka smo uporabili opisno metodo zbiranja podatkov. Literaturo smo pridobivali iz podatkovnih zbirk , kot so Google učenjak, Cobiss+, PubMed in ScienceDirect. Časovni okvir iskanja literature je bil nastavljen od leta 2012 do 2022.

Rezultati: Rezultati pregleda literature kažejo, da tehnika TT zagotavlja višjo homogenost porazdelitve doze znotraj PTV. Parametra D2 % (CK: 46,37 Gy, 46,46 Gy, 45Gy, 39,8 Gy; TT: 45,19 Gy, 39,86 Gy, 37,5 Gy, 36,5 Gy) in D98 % (CK: 36,27 Gy, 36,95 Gy, 34,3 Gy; TT: 36,97 Gy, 37,37 Gy, 36,4 Gy) nakazujeta, da se pri CK pojavlja več vročih in hladnih točk v PTV kot pri TT. Pri TT so bili parametri D2 %, V20 %, V30 %, V50 % za rektum nižji kot pri CK.

Razprava in zaključek: Na podlagi rezultatov smo ugotovili, da TT zagotavlja višjo homogenost porazdelitve doze znotraj PTV, kljub temu pa sta obe obsevalni tehniki med seboj zelo primerljivi. Hkrati je TT pokazala boljše rezultate pri zaščiti rektuma kot CK, kar bi potencialno lahko vodilo do manjšega števila kasnejših stranskih učinkov.

Ključne besede: rak prostate, tomoterapija, Cyber nož, rektum, dozimetrična pokritost, homogenost

ABSTRACT

Introduction: Various radiotherapy techniques for treating prostate cancer have been considered effective non-invasive treatment options, for example tomotherapy (TT) and Cyberknife (CK). CK is a system of a 6-megavolt (MV) linac mounted to a robotic arm that provides intra-fraction target motion, which gives a very high delivery accuracy and can better protect organs at risk, for example the rectum. However, most hospitals cannot provide treatment with CK. Frequently, in the countries that can offer various techniques, prostate cancer patients are therefore treated with TT, which is also a very accurate radiation treatment.

Purpose: The purpose of this scientific poster is to compare the differences in dose homogeneity inside planning target volume (PTV) and rectal sparing in patients with prostate cancer between CK and TT treatment. We would also like to raise awareness about special techniques in radiotherapy among radiologic technologists in Slovenia.

Method: A descriptive method was used for the writing of this scientific poster. Literature was sourced from Google Scholar, PubMed and ScienceDirect, where the timeline was limited to articles published between 2012 and 2022.

Results: Results show that TT provides a higher homogenous dose distribution inside PTV than CK. Parameters D2 % (CK: 46.37 Gy, 46.46 Gy, 45Gy, 39.8 Gy; TT: 45.19 Gy, 39.86 Gy, 37.5 Gy, 36.5 Gy) and D98 % (CK: 36.27 Gy, 36.95 Gy, 34.3 Gy; TT: 36.97 Gy, 37.37 Gy, 36.4 Gy) indicate that CK has more volume of hot and cold spots inside PTV than TT. When considering the dose delivery for the rectum, parameters D2 %, V20 %, V30 %, V50 % were lower for TT than CK.

Discussion and conclusion: TT has shown to provide slightly higher dose homogeneity inside the PTV than TT, yet both techniques are comparable and therefore hospitals can decide to use either CK or TT. Additionally, there is a slightly better outcome in rectal sparing with TT than CK, which could potentially translate into the advantage of lower late rectal toxicity.

Keywords: prostate cancer, tomotherapy, Cyberknife, rectal sparing, dosimetric outcome, homogeneity

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ARTERIOGRAFIJA SPODNJIH OKONČIN Z NADALJEVANJEM V PERKUTANO TRANSLUMINALNO ANGIOPLASTIKO V SPLOŠNI BOLNIŠNICI MURSKA SOBOTA

LOWER EXTREMITY ARTERIOGRAPHY WITH CONTINUATION IN PERCUTANEOUS TRANSLUMINAL ANGIOPLASTY AT THE MURSKA SOBOTA GENERAL HOSPITAL

Denis Števanec, Anita Kosi

Splošna bolnišnica Murska Sobota, Oddelek za radiologijo, Ulica dr. Vrbnjaka 6, 9000 Murska Sobota, Slovenija / General hospital Murska Sobota, Department of Radiology, Ulica dr. Vrbnjaka 6, 9000 Murska Sobota, Slovenia

Korespondenca / Corresponding author: denis.stevanec@gmail.com

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IZVLEČEK

Uvod in namen: Arteriografija spodnjih okončin je temeljna slikovna metoda, s katero prikažemo mesto in obseg žilne zapore. Ob ugotovljeni žilni zapori se arteriografija lahko nadaljuje v poseg, tj. PTA (perkutana transluminalna angioplastika), kjer zdravnik radiolog z balonom oz. stentom poveča pretok krvi v zoženi žili (Blinc in drugi, 2004).

Namen plakata je predstavitev primera ter protokola slikanja v Splošni bolnišnici Murska Sobota.

Metode: Pregledali smo literaturo, opisali primer iz naše bolnišnice ter predstavili protokol slikanja, ki ga uporabljamo pri arteriografiji in PTA spodnjih okončin v naši bolnišnici.

Rezultati in razprava: Zaradi kratke klavdikacijske razdalje je bil na ultrazvočno preiskavo spodnjih okončin z dopplerjem napoten pacient, star 70 let. Razdalja, ki jo je prehodil, je bila 20 metrov. Po opravljenem dopplerju je bila ugotovljena okluzija arteriae femoralis superficialis (AFS) sinister. Glede na diagnozo je bil pacient predlagan za levostransko arteriografijo in PTA spodnje okončine.

Pred začetkom posega inštrumentarka pripravi material, ki ga bomo uporabljali pri preiskavi. Pripravi pacienta, ga namesti na preiskovalno mizo, sterilno umije vbodno mesto in ga sterilno pokrije.

Na začetku posega zdravnik aplicira lokalni anestetik, s Seldingerjevo tehniko zbode arterio femoralis sinister, preko žice odstrani iglo in uvede 5fr. žilno uvajalo. Nato radiološki inženir opravi levostransko arteriografijo z naslednjim protokolom: na rentgenskem aparatu izbere protokol DSA low dose spodnjih okončin z ekspozicijskimi pogoji: 4 p/s in 3 f/s. Slika v AP projekciji. Uporabi kontrastno sredstvo Visipaque 320. Na injektorju izbere naslednje parametre: pretok 4 ml/s, količina kontrasta 15 ml, pritisk 600 psi.

Arteriografija prikaže 10 cm dolgo okluzijo AFS v srednjem delu.

Po opravljeni arteriografiji se zdravnik odloči za PTA AFS sin. S Terumo žico in Support katetrom premosti okluzijo in jo dilatira z dilatacijskim balonom dimenzij 5x150 mm. Kontrolna arteriografija pokaže dobro pretočnost brez rezidualne stenoze ali disekcije.

Zaključek: Z arteriografijo spodnjih okončin prikažemo mesto in obseg žilne zapore, ki se lahko nadaljuje v poseg PTA.

Obravnavali smo 70-letnega pacienta s težavami pri hoji. Z arteriografijo smo ugotovili zaporo AFS, ki jo zdravnik dilatira. Kontrolna arteriografija pokaže dobro prehodnost AFS.

Ključne besede: Arteriografija, perkutana transluminalna angioplastika, žilna zapora.

ABSTRACT

Introduction and purpose: Lower extremity arteriography is the basic imaging modality used to visualize the location and extent of vascular occlusion. If vasoconstriction is diagnosed, arteriography can be followed up with a procedure called PTA (percutaneous transluminal angioplasty), in which a radiologist uses a balloon or stents to increase blood flow in a narrowed vessel (Blinc et al., 2004).

The purpose of this poster is to present the case and imaging protocol at the Murska Sobota General Hospital.

Methods: We reviewed the literature, described an example from our hospital and presented the imaging protocol we use in arteriography and PTA of the lower extremities at our hospital.

Results and discussion: A 70-year-old patient was referred for ultrasonography of the lower extremities with Doppler because of the short distance of claudication. The distance he walked was 20 meters. After Doppler, occlusion of the superficial femoral artery (Lat. arteriae femoralis superficialis, AFS) sinister was detected. Depending on the diagnosis, it was recommended that the patient undergo left arteriography and PTA of the lower extremities.

Before starting the procedure, the instrumentalist prepares the material to be used in the examination. They also prepare the patient, place him on the examination table, wash the puncture site sterilely and cover him sterilely.

At the beginning of the procedure, the physician administers a local anaesthetic, punctures the femoral sinister artery using the Seldinger technique, removes the needle over the wire, and inserts a 5fr. vascular introducer. The radiology technician then performs left-sided arteriography according to the following protocol: on the X-ray machine, he selects the DSA protocol with low dose for the lower extremities, with exposure conditions: 4 p/s and 3 f/s. Image in AP projection. Use Visipaque 320 contrast agent. Select the following parameters on the injector: flow rate 4 ml/s, contrast agent volume 15 ml, pressure 600 psi.

Arteriography shows a 10 cm occlusion of the AFS in the centre.

After performing arteriography, the physician decides to use PTA AFS sin. The occlusion is bridged with Teruma wire and a support catheter, and dilated with a 5x150 mm dilatation balloon. Control arteriography shows good flow without residual stenosis or dissection.

Conclusion: Lower extremity arteriography shows the location and extent of vasoconstriction, which can be continued in PTA surgery.

We treated a 70-year-old patient who had difficulty walking. Arteriography showed AFS blockage, which the physician dilated. Control arteriography showed good AFS transit.

Keywords: Arteriography, percutaneous transluminal angioplasty, vessel occlusion

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UVEDBA AVTOMATSKE ANALIZE CT SLIK PRI IZVEDBI PROTOKOLA ZA MOŽGANSKO KAP: VIDIK RADIOLOŠKEGA INŽENIRJA

INTRODUCTION OF AUTOMATIC CT IMAGE ANALYSIS IN THE IMPLEMENTATION OF THE STROKE PROTOCOL: ASPECT OF THE RADIOLOGICAL ENGINEER

Tomaž Zakrajšek, Matej Podsedenšek, Andrej Breznik

Splošna Bolnišnica Celje, Radiološki oddelek, Oblakova ulica 5, 3000 Celje, 1000 Slovenija /
General Hospital Celje, Department of Radiology, Oblakova ulica 5, 3000 Celje, 1000 Slovenia

Korespondenca / Corresponding author: tomaz.zakrajsek@sb-celje.si

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IZVLEČEK

Uvod: V Splošni bolnišnici Celje smo se v mesecu novembru pridružili izvajanju pilotnega projekta, kjer se vsem pacientom ob sumu na ishemično možgansko kap izvede računalniška obdelava CT slik s pomočjo programa E-Stroke® . V projekt sta poleg Splošne bolnišnice Celje vključeni še Splošna bolnišnica Izola in Nevrološka klinika Univerzitetnega kliničnega centra Ljubljana. E-Stroke® Suite (Brainomix, Oxford, Združeno Kraljestvo) je računalniško orodje za avtomatiziran proces zgodnjega odkrivanja in ocenjevanja obsega možganske kapi.

Namen: Namen je predstavitev procesa uporabe programa E-Stroke® z vidika radiološkega inženirja.

Metode: Samodejna programska analiza podatkov pridobljenih pri slikanju protokola za možgansko kap; CT glave brez kontrasta, CTA aorto cervikalna in CT perfuzija možganov.

Rezultati in razprava: Med rezultati, ki so pregledani v časovnem obdobju od 10. 11. 2021 do 5. 2. 2022 smo izbrali najzanimivejši primer. Program nam omogoča oceno točkovne lestvice za oceno ishemičnih volumnov možganov ASPECTS (angl. Alberta stroke programme early CT score), avtomatično iskanje večjih zapor glavnih in obsega obvodnih žil ter izračun jedra (e-CTA), penumbre in razmerja neusklajenosti s pomočjo prikaza perfuzijskih map (e-CTP).

Zaključek: Programska oprema E-Stroke® temeljito ne spremeni postopka delovnega procesa preiskave z vidika radiološkega inženirja kot izvajalca preiskave, saj moramo dodatno narediti MIP in VRT rekonstrukcije žil. Poglavitna prednost uporabe programa je hitrejša obdelava in konzultacija s strani napotnega zdravnika in odgovornega zdravnika v referenčnem centru.

Ključne besede: možganska kap, Brainomix, računalniška tomografija, perfuzija, angiografija

ABSTRACT

Introduction: In November, we participated in the implementation of a pilot project at the Celje General Hospital, where all patients with suspected ischemic stroke underwent the computer processing of CT images with the help of the E-Stroke® program. In addition to the Celje General Hospital, the project also includes the Izola General Hospital and the Neurological Clinic at the University Medical Centre Ljubljana. The E-Stroke® Suite (Brainomix, Oxford, UK) is a computer tool for the automated early detection and evaluation of stroke area.

Purpose: The purpose is to present the use of the E-Stroke® program from the point of view of a radiological engineer.

Methods: Automatic software analysis of data obtained from stroke protocol imaging; CT head non-contrast, CTA aorta cervical and CT brain perfusion.

Results and discussion: Among the results reviewed in the period from 10 November 2021 to 5 February 2022, we chose the most interesting case. The program enables the evaluation of ASPECTS (Alberta stroke program early CT score) scoring scales for evaluating ischemic brain volumes, automatic search of acute arterial occlusion, collateral blood vessels and calculation of the nucleus (e-CTA), penumbra and mismatch by displaying perfusion maps (e-CTP).

Conclusion: E-Stroke® software does not fundamentally change the procedure of the investigation workflow from the point of view of the radiological engineer as the investigator. After all, we need to perform the additional MIP and VRT reconstruction of blood vessels. The main advantage of using the program is faster processing and consultation by the referring physician and the responsible physician in the reference centre.

Keywords: Stroke, Brainomix, computed tomography, perfusion, angiography

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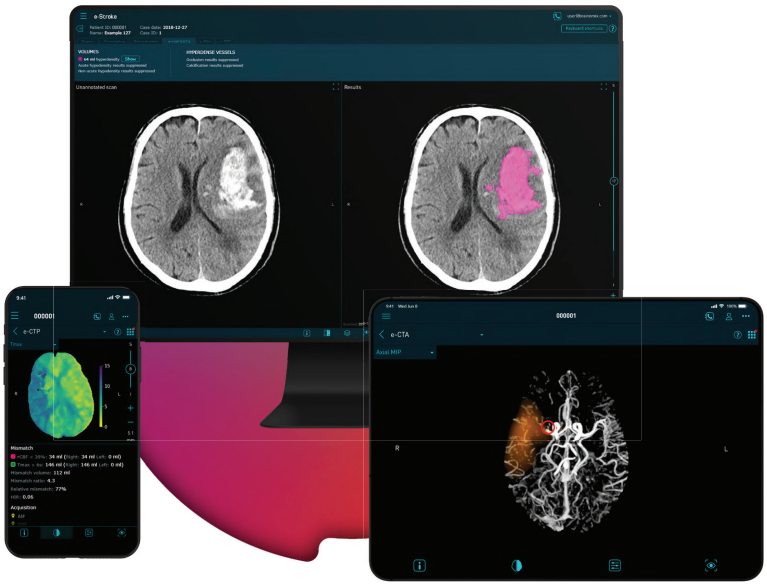

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