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MIRTJ je namenjen objavi člankov z vseh področij diagnostičnega slikanja (diagnostična 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 MIRTJ-ju objavljamo tudi sindikalne novosti ter informacije o izobraževanju, hkrati pa omogoča tudi izmenjavo informacij in mnenj radioloških inženirjev.

The MIRTJ is an official journal of the Society of Radiographers of Slovenia with external reviews. The purpose of the MIRTJ 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 MIRTJ also contains trade union news and information about education and training, in addition to offering the opportunity to radiographers to exchange information and opinions.

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Spoštovane kolegice in kolegi,

pred vami je Zbornik predavanj in plakatov 6. kongresa Strokovnega združenja radioloških inženirjev Slovenije, ki je izšel kot suplement revije Medical Imaging and Radiotherapy Journal (MIRTJ). Ob 70. obletnici delovanja združenja, ki smo jo obeležili na tem kongresu, se je vredno ozreti nazaj na prehojeno pot in opazovati, kako zelo sta naš poklic in naša stroka napredovala. To se odraža tudi na vsebini tega zbornika, saj avtorji predstavljajo zanimive, inovativne, tehnološko najnaprednejše posege, postopke in intervencije, pri katerih kot vodilni ali aktivni člani ekip sodelujejo radiološki inženirji. Želja po raziskovalnem delu in nivo, na katerega se je slednje dvignilo med našimi kolegi, nas lahko navdaja z optimizmom, da bo naslednjih 70 let zagotovo še uspešnejših.

Zahvaljujeva se vsem avtorjem in predavateljem za pogum, da se udejstvujete v raziskovanju, recenzentom in moderatorjem pa, da ste si pripravljeni vzeti čas in sodelovati. Hvala tudi organizacijskemu in strokovnemu odboru za naporno, a prijetno načrtovanje, pripravo in izvedbo jubilejnega kongresa.

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RAČUNALNIŠKO TOMOGRAFSKE IN MAGNETNORESONANČNE LASTNOSTI KRVNIH STRDKOV PRI ISHEMIČNI MOŽGANSKI KAPI

COMPUTED TOMOGRAPHIC AND MAGNETIC RESONANCE CHARACTERISTICS OF BLOOD CLOTS IN ISCHEMIC STROKE

Rebeka Viltužnik[1], Igor Serša[2] Franci Bajd[3], Zoran Miloševič[4], Igor Kocijančič[4], Miran Jeromel[5], Andrej Fabjan[2], Eduard Kralj[6], Jernej Vidmar[2,7], Aleš Kaučič[7], Aleš Blinc[8,9]

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IZVLEČEK

Uvod in namen: Ishemično možgansko kap povzročajo trombi, katerih lastnosti vplivajo na izid zdravljenja. Optimiziranje protokola obravnave kapi je nujno za boljši izid zdravljenja, kjer za slikovno diagnostiko večinoma uporabljamo CT, čeprav se je MR izkazal za boljšo metodo. Ne glede na slikovno diagnostiko doslej ni bilo poudarka na ugotavljanju lastnosti trombov. Z namenom nadaljnjega optimiziranja protokola obravnave kapi smo raziskali možnost CT in MR meritev za določanje strukture umetnih trombov, hkrati smo te ugotovitve umestili tudi v klinično okolje.

Metode: Najprej smo preiskovali učinkovitost CT in MR analize pri definiranju strukture umetnih trombov. V kliničnem delu so bili obravnavani pacienti s potrjeno ishemično možgansko kapjo, pri katerih so uspešno odstranili trombe in jih analizirali z MR ter histološko. Od pacientov smo pridobili še klinične podatke in podatke zdravljenja ter obdelali CT slike, kjer smo pridobili *in vivo* HU meritve trombov. Vse smo ustrezno statistično obdelali.

Rezultati: Računalniško tomografske in magnetnoresonančne difuzijske meritve umetnih trombov so uspešno razlikovale med eritrocitnimi in trombocitnimi trombi, hkrati so bile vse meritve občutljive na spremembe v deležu eritrocitov. V klinični študiji smo ugotovili pomembne korelacije med variabilnostjo difuzije in trajanjem mehanske rekanalizacije, odstopanjem v povprečnem številu HU in številom prehodov pri trombektomiji, dolžino tromba, deležu eritrocitov in drugimi dejavniki.

Razprava in zaključek: CT in MR uspešno razlikujeta med različnimi sestavami umetnih trombov. S klinično študijo smo ugotovili, da nekateri CT in MR slikovni parametri korelirajo s kliničnimi parametri in parametri zdravljenja. Na podlagi ugotovitev naše raziskave je nadaljnje optimiziranje obravnave kapi mogoče in prav naša raziskava je lahko podlaga za nadaljnjo raziskovalno delo na tem področju, kjer napredek v CT (spektralni CT) in MR diagnostiki nakazuje, da se lahko bolj osredotočimo tudi na lastnosti trombov.

Ključne besede: CT, MR, trombi, možganska kap, klinični parametri kapi, mehanska trombektomija

ABSTRACT

Introduction and purpose: Ischemic stroke is caused by thrombi, whose properties can affect treatment outcome. Optimising stroke protocol is essential for better results, where CT is most commonly used in imaging diagnostics, although MR is more efficient. Regardless of the imaging modality, no emphasis is placed on the characterisation of thrombi. With the aim of further optimising stroke protocol, we investigated the possibility of CT and MR measurements in defining the structure of artificial thrombi. We also applied these findings clinically.

Methods: We first investigated effectiveness of CT and MR analysis in defining the structure of artificial thrombi. In the clinical part, patients with confirmed ischemic stroke had successfully removed thrombi, which were later analysed by MR and histology. Clinical and treatment data were also obtained, as well as HU from the corresponding CT images of thrombi. All data were appropriately statistically analysed.

Results: CT and MR diffusion measurements of artificial thrombi successfully differentiated between RBC and platelet thrombi, while all measurements were sensitive to changes in RBC proportion. During our clinical study, we found significant correlations between the variability of diffusion and the duration of mechanical recanalization, deviation in mean HU and the number of passes with the thrombectomy device, length of the thrombus, RBC proportion, and other factors.

Discussion and conclusion: CT and MR successfully differentiate between different artificial thrombi structures. Through our clinical study, we found strong correlations between imaging parameters (CT and NMR) and clinical/treatment parameters. According to these findings, the further optimization of stroke treatment is possible, while our study may serve as a basis for further research in this area, where advances in CT (spectral CT) and MR diagnostics suggest that we can focus more on thrombi properties.

Keywords: CT, MR, thrombi, stroke, stroke clinical parameters, mechanical thrombectomy

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DIREKTNA MAGNETNORESONANČNA ARTROGRAFIJA KOLKA S TRAKCIJO – PREDSTAVITEV PRIMEROV

DIRECT MR ARTHROGRAPHY OF THE HIP WITH LEG TRACTION – CASE STUDIES

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IZVLEČEK

Uvod in namen: Magnetnoresonančna artrografija kolka je minimalno invazivna in najobčutljivejša diagnostična metoda za oceno acetabularnega labruma in sklepnega hrustanca kolka.

Namen prispevka je predstaviti protokol MR artrografije kolka s trakcijo, kot jo izvajamo v naši ustanovi, ter prikazati glavne značilnosti v primerjavi s klasično MR artrografijo kolka brez trakcije.

Metode: Izbrali smo nekaj primerov preiskovancev, pri katerih smo opravili MR artrografijo kolka s trakcijo in brez nje, ter retrospektivno primerjali prikaz znotrajsklepnih anatomskih struktur. Prikaz znotrajsklepnih struktur je ocenjeval zdravnik radiolog.

Pred začetkom MR preiskave se pacientu punktira kolčni sklep in vbrizga kontrastno sredstvo. Na ta način se na MR slikah poveča kontrast med sklepno tekočino in znotrajsklepnimi strukturami. Ob tem kontrastno sredstvo razpne sklepno ovojnico in razmakne znotrajsklepne strukture, ki sicer ležijo v tesnem stiku med seboj, in jih je zato pri slikanju brez kontrastnega sredstva težje ocenjevati. Kontrastno sredstvo izpolni tudi defekte sklepnega hrustanca in labruma, kar omogoča detekcijo že zelo majhnih poškodb. Za izboljšan prikaz in oceno labruma ter sklepnega hrustanca se lahko po aplikaciji kontrastnega sredstva v sklep izvede tudi aksialna trakcija noge, ki jo izvedemo pred začetkom preiskave, ko pacient leži na mizi magnetnoresonančnega tomografa. Na ta način se razpre sklepna špranja kolčnega sklepa, da lahko kontrast oblije sklepni hrustanec v celotnem delu. Vse preiskave smo opravili z MR tomografom Siemens Magnetom Vida 3T. Za izvedbo trakcije smo uporabili namenski pripomoček, ki smo ga izdelali v naši ustanovi.

Rezultati in razprava: Ugotavljamo, da pri MR artrografiji s pomočjo trakcije dosežemo boljši prikaz znotrajsklepnih struktur, zlasti hrustančnih površin. Zato je preiskava bolj občutljiva za oceno poškodb, predvsem delaminacije hrustanca, v primerjavi s klasično MR artrografijo kolka, kar je v skladu s študijami iz literature.

Zaključek: MR artrografija s trakcijo je najnatančnejša diagnostična preiskava za oceno znotrajsklepnih struktur. Pri tem je ključnega pomena pravilna izvedba preiskave (pravilna namestitev pacienta, izvedba trakcije z ustrezno silo ter ustrezno planiranje pulznih zaporedij glede na želeni prikaz anatomskih struktur), pri kateri ima radiološki inženir zelo pomembno vlogo. Le na ta način se lahko zagotovi visoko diagnostično vrednost pridobljenih MR slik.

Ključne besede: direktna magnetnoresonančna artrografija, MR artrografija, MR artrografija kolka, trakcija

ABSTRACT

Introduction and Purpose: Magnetic Resonance (MR) arthrography of the hip represents a minimally invasive and highly sensitive diagnostic modality for the assessment of the acetabular labrum and hip articular cartilage. The purpose of this contribution is to present the protocol for hip MR arthrography with traction, as conducted in our institution, and to elucidate its key characteristics in comparison to conventional MR arthrography of the hip without traction.

Methods: A selection of patients underwent MR arthrography of the hip with and without traction, and a retrospective comparison was conducted to evaluate the depiction of intra-articular anatomical structures. The assessment of intra-articular structures was performed by a radiologist. Prior to the initiation of the MR examination, the hip joint was punctured, and a contrast agent was injected. This method enhances the contrast between the synovial fluid and intra-articular structures on MR images. The contrast agent distends the joint capsule and separates intra-articular structures, which are otherwise closely apposed, making their assessment challenging without contrast enhancement. Additionally, it fills defects in the articular cartilage and labrum, facilitating the detection of even minute injuries. For improved visualization and assessment of the labrum and articular cartilage, axial traction of the leg was applied after the administration of the contrast agent, performed before the examination while the patient lies on the magnetic resonance imaging (MRI) table. This manoeuvre opens the joint space of the hip, allowing the contrast agent to cover the entire joint cartilage. All examinations were conducted using a Siemens Magnetom Vida 3T MRI scanner. A dedicated device, fabricated at our institution, was utilized for traction during the procedure.

Results and Discussion: Our findings indicate that MR arthrography with traction achieves the superior visualization of intraarticular structures, particularly articular surfaces. Consequently, this imaging modality exhibits greater sensitivity for the assessment of injuries, particularly cartilage delamination, compared to conventional hip MR arthrography, aligning with existing literature studies.

Conclusion: MR arthrography with traction emerges as the most precise diagnostic examination for evaluating intra-articular structures. The proper execution of the procedure, including correct patient positioning, the application of traction with appropriate force, and the meticulous planning of pulse sequences for the desired depiction of anatomical structures, is of the utmost importance. In this regard, the radiographer plays a crucial role. Only through such meticulous execution can a high diagnostic value be assured for obtained MR images.

Keywords: Direct magnetic resonance arthrography, MR arthrography, hip MR arthrography, traction

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ANANASOV SOK IN MAGNETNORESONANČNA HOLANGIOPANKREATOGRAFIJA. UČINKOVITOST KOT NEGATIVNO ORALNO KONTRASTNO SREDSTVO – PRIMERJALNA ŠTUDIJA

PINEAPPLE JUICE AND MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY. EFFICACY AS A NEGATIVE ORAL CONTRAST AGENT – COMPARATIVE STUDY

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IZVLEČEK

Uvod in namen: Magnetnoresonančna holangiopankreatografija (MRCP) je neinvazivna tehnika, ki omogoča dostop do pankreatobiliarnega sistema. Med MRCP so lahko pankreatobiliarni vodi zakriti zaradi intenzivnega signala iz želodca in dvanajstnika. Ananasov sok (AS) je lahko alternativa komercialno dostopnim negativnim kontrastnim sredstvom, vendar lokalno še ni bil ocenjen.

Metode: Radiološki oddelek Univerzitetnega kliničnega centra Republike Srbske je izvedel opazovalno, primerjalno analitično študijo. Raziskava je bila opravljena z 10 bolniki, pri katerih so bile opravljene preiskave MRCP, in 10 zdravimi prostovoljci. Zaporedje MRCP z 1,5 Tesla je bilo izvedeno neposredno pred zaužitjem 400 ml lokalnega, komercialno dostopnega pripravka AS ter 15 in 30 minut po zaužitju. Slike sta slepo ocenila dva radiologa svetovalca s standardno tehniko razvrščanja, ki je temeljila na učinku kontrasta (stopnja supresije signala črevesja) in učinku slike (diagnostična kakovost). Primerjal sem pridobljene rezultate z rezultati iz drugih študij.

Rezultati: Zlasti občutno se je izboljšala vizualizacija pankreatičnega voda, ampule in žolčnih vodov. Vendar med slikami, pridobljenimi 15 minut in 30 minut po zaužitju, ni bilo bistvene razlike, medtem ko je primerjalni članek pokazal, da v trgovini kupljena, priročno pakirana in enostavno zaužljiva količina ananasovega soka izboljša kakovost slikanja MRCP.

Razprava in zaključek: Pripravek AS, uporabljen v tej študiji, je učinkovito, cenovno dostopno in naravno negativno oralno kontrastno sredstvo, ki zagotavlja učinkovito supresijo signala v gastrointestinalnem traktu pri MRCP.

Ključne besede: MRCP, ananasov sok, negativno oralno kontrastno sredstvo, pankreatobiliarni vodi

ABSTRACT

Introduction: Magnetic resonance cholangiopancreatography (MRCP) is a non-invasive technique that allows access to the pancreato-biliary system. During MRCP, the pancreaticobiliary ducts can be obscured by the high-intensity signal from the stomach and duodenum. Pineapple juice (PJ) may be an alternative to commercially available negative contrast agents but has not been evaluated locally.

Methods: An observational, comparative analytical study was conducted by the radiology department of the University Clinical Centre of Republika Srpska. The research was done with 10 patients subjected to MRCP exams and 10 healthy volunteers.

A 1.5 Tesla MRCP sequence was performed immediately before and 15 and 30 minutes following the ingestion of 400 mL of a local, commercially-available PJ preparation. Images were assessed blindly by two consultant radiologists using a standard grading technique based on contrast effect (degree of suppression of bowel signal), and image effect (diagnostic quality).

I compared the obtained results with the results from other studies.

Results: There was a particularly significant improvement in the visualization of the pancreatic duct, ampulla, and bile ducts. However, there was no significant difference between images acquired 15 minutes and 30 minutes after consumption, while a comparative article demonstrated that a store-bought, conveniently packaged and easily consumable quantity of pineapple juice improves the quality of MRCP imaging.

Conclusion: The PJ preparation used in this study is an effective, affordable and natural negative oral contrast agent which provides effective signal suppression in the GI tract on MRCP.

Keywords: MRCP, pineapple juice, negative oral contrast, pancreaticobiliary ducts,

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NAKLJUČNE NAJDBE PRI MAGNETNORESONANČNEM SLIKANJU LEDVENE HRBTENICE

INCIDENTAL FINDINGS OF THE LUMBAR SPINE AT MAGNETIC RESONANCE

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IZVLEČEK

Uvod: Naključna najdba je predhodno nepoznana in nepričakovana sprememba, ki ni povezana z namenom opravljene preiskave, vendar ima potencialno kliničen pomen. Naključne najdbe so lahko benigne ali maligne bolezenske spremembe, lahko so pomembnejše od bolezni, zaradi katere je pacient napoten na magnetno resonanco (MR) ledvene hrbtenice (LS).

Namen: Namen prispevka je raziskati pojavnost in vrsto ugotovljenih naključnih najdb pri pacientih, ki so napoteni na MR LS zaradi suma hernije medvretenčne ploščice v Ortopedski bolnišnici Valdoltra (OBV) v dveh različnih obdobjih, in sicer leta 2019 in leta 2022. Vključili smo najdbe, ki so prisotne v ledvenem predelu hrbtenice: hemangiome, tarlove ciste, sinovialne ciste, sakralne meningokele, tumorje ter vnetja. Na podlagi sistematičnega pregleda literature je bil glavni cilj izvedeti, kakšna so odstopanja oz. podobnosti v rezultatih z ostalimi raziskavami, ki so bile izvedene v tujini.

Metode dela: V sklopu sistematičnega pregleda literature je bilo pregledanih in analiziranih 14 člankov, ki se navezujejo na temo naključnih najdb pri MR LS preiskavah. Drugi del raziskave je bil retrospektiven. Zajemal je paciente OBV, ki so bili napoteni na MR LS preiskavo zaradi suma na hernijo medvretenčne ploščice. Raziskava je vključevala 1753 pacientov. Število pacientov glede na spol in starost smo prikazali s pomočjo kontingenčnih tabel, za opis smo uporabili frekvence. Deleže smo med seboj primerjali s hi-kvadrat testom.

Rezultati: Odstotek ugotovljenih naključnih najdb je bil 15 % (264 primerov). Najpogosteje so bili diagnosticirani vertebralni hemangiomi (10 %, 169 primerov). Odstotek diagnosticiranih tarlovih cist je bil 3 % (58 primerov), sinovialnih cist pa 2 % (34 primerov). Pri enem pacientu so diagnosticirali sakralno meningokelo, pri 2 pacientih so diagnosticirali tumor hrbtenice. Vnetje ledvene hrbtenice ni bilo naključno diagnosticirano pri nobenem pacientu, ki je bil vključen v raziskavo. Najmanjši ugotovljen odstotek naključnih najdb v tuji literaturi je bil 7,8 %, največji odstotek 34,2 % [95 % CI: 14,8 %; 25,8 %], povprečen odstotek naključnih najdb pa 20,3 %.

Razprava in zaključek: Naključne najdbe so bile pogoste in povezane s starostjo in spolom ($p < 0,05$). Večina je bila benignih najdb. V raziskavi smo ugotovili, da imajo naključne najdbe pomembno vlogo pri razvoju in napredku zdravstvene znanosti in klinične prakse.

Ključne besede: magnetna resonanca, ledvena hrbtenica, naključne najdbe

ABSTRACT

Introduction: An incidental finding (IF) is a previously unexpected lesion that is unrelated to the reason of the examination but has potential clinical significance. During the magnetic resonance imaging (MRI) of the lumbar spine (LS), various IF can be observed in the spinal column and extraspinal tissues.

Purpose: The aim of this study was to evaluate and analyse the incidence and type of spinal IF in patients referred for LS MRI due to suspected herniated intervertebral disk disease. Our study population included patients from Valdoltra Orthopaedic Hospital (OBV) who underwent imaging between 2019 and 2022. Vertebral haemangioma, Tarlov cyst, synovial cist, sacral meningocele, discitis of the lumbar spine and spinal tumours were included. Based on a systematic review of existing literature, the main objective was to identify similarities in the results with other studies performed abroad.

Methods: As part of a systematic literature review, 14 articles related to IF in LS MRI examinations were analysed. The second part of the study was retrospective, involving 1,753 patients from OBV who were referred for LS MRI examination because of clinically suspected herniated intervertebral discs. The number of patients according to age and gender was displayed using contingency tables, while frequencies were used for description. The chi-square test was used for the analysis of the relationship of IF with patient characteristics.

Results: Overall, IF were present in 264 patients (15 %). Vertebral haemangiomas were the most common IF (169 patients or 10%), followed by Tarlov cysts (58 patients or 3%) and synovial cysts (34 patients or 2%). One patient was diagnosed with sacral meningocele and two patients were diagnosed with spinal tumours. No lumbar spine inflammation was diagnosed incidentally in any of the patients included in the study. The lowest reported incidence of IF in previous studies was 7.8%, the highest incidence was 34.2% [95% CI: 14.8%–25.8%]. The average of IF in previous studies was 20.3%.

Discussion and conclusions: IF in LS MRI were common and associated with age and gender ($p < 0.05$). Most of them were benign findings. IF play a crucial role in improving medical practice and discovering new approaches to treatment.

Keywords: MRI, lumbar spine, incidental findings, incidental lesions

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NAČINI TESTIRANJA IN KONTROLA CELOVITOSTI OSEBNE VAROVALNE OPREME V DIAGNOSTIČNI RADIOLOGIJI

TESTING METHODS AND VERIFYING THE INTEGRITY OF PERSONAL PROTECTIVE EQUIPMENT IN DIAGNOSTIC RADIOLOGY

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Uvod: Število radioloških preiskav se iz leta v leto povečuje, prav tako pa tudi poklicna izpostavljenost sevanju. Da bi bila doza, ki jo zaposleni prejme, najnižja možna, je nujna uporaba osebne varovalne opreme (OVO), ki mora biti celovita in nepoškodovana.
Namen: Namen raziskave je bil ugotoviti, katera metoda iskanja poškodb na zaščiti je najučinkovitejša. Zanimalo nas je tudi, koliko se poveča prejeta doza za zaposlenega, če uporablja poškodovano OVO.
Metode dela: Pregledali smo 64 zaščitnih plaščev z vsemi štirimi tehnikami pregledovanja, tj. vizualni in palpatorni pregled, pregled s svetlobo, pregled z računalniškim tomografom ter pregled z diaskopijo ali rentgenskim slikanjem, in ugotavljali, katera je najučinkovitejša. Nato smo izmerili dozo za nepoškodovanim in poškodovanim delom istega plašča v primarnem in sekundarnem snopu rentgenske svetlobe.
Rezultati: Z rentgenskim ali diaskopskim pregledom smo odkrili 16 poškodb, eno manj s CT-jem, z vizualnim in palpatornim pregledom smo odkrili 11 poškodb, pri pregledu s svetlobo pa 6 poškodb. Pri meritvah v primarnem snopu smo ugotovili, da je povprečni delež prepustnosti rentgenskih žarkov za napakami najmanjši pri plašču 1 (0,5 %) in največji pri plašču 31 (316,6 %). Prav tako, so bile najmanjše vrednosti v sekundarnem snopu sevanja izmerjene pri plašču 1 (1,3 %), največje pa pri plašču 48 (1643 %).
Razprava in zaključek: Iz dobljenih rezultatov lahko trdimo, da sta najučinkovitejši metodi odkrivanja napak tisti, pri katerih se uporablja rentgenska svetloba. Pri meritvah prepustnosti primarnega in sipanega sevanja smo ugotovili, da obstajajo statistično pomembne razlike med poškodovanim in nepoškodovanim delom. Prav tako smo ugotovili, da je treba določeno OVO umakniti iz nadaljnje uporabe.
Ključne besede: osebna varovalna oprema, kontrola celovitosti, pregledovanje osebne varovalne opreme, poklicna izpostavljenost sevanju

ABSTRACT

Introduction: The number of radiological examinations is increasing from year to year, as is occupational exposure to radiation. The use of personal protective equipment (PPE) is essential to minimize the dose to the employee. PPE is expected to be complete and undamaged.
Purpose: The purpose of the study was to determine which method is most effective for damage detection in shielding. We also wanted to determine how much the dose an employee receives is increased when using damaged PPE.
Methods: 64 coats were first examined using all four examination techniques: visual and palpatory examination, light examination, computed tomography examination and diascopy or X-ray examination, to determine which was most effective. We then measured the dose behind the intact and the damaged part of the same shield, in the primary and secondary X-ray beam.
Results: 16 defects were detected by X-ray or diascopic examination, one less by CT, 11 defects were detected by visual and palpatory examination, while six defects were detected by light examination. In the primary beam measurements, we found that the average proportion of X-ray transmission behind the defects was lowest in shield 1 (0.5 %) and highest in shield 31 (316.6 %). Similarly, the lowest values in the secondary beam were measured in shield 1 (1.3 %) and the highest in shield 48 (1643 %).
Discussion and conclusion: It was determined that the best detection method for evaluating damage to PPE is the method where ionizing radiation was used. When measuring the transmittance of primary and scattered radiation, we found that there were statistically significant differences between damaged and undamaged parts. We also concluded that certain PPE should not be used further.
Keywords: personal protective equipment, integrity check, inspection of personal protective equipment, occupational exposure to radiation

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DOLOČANJE KALCIJEVEGA BREMENA V KORONARNIH ARTERIJAH: CT PROTOKOLI

DETERMINATION OF CALCIUM LOAD IN CORONARY ARTERIES: CT PROTOCOLS

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Uvod in namen: Ocene kalcijevega bremena v koronarnih arterijah, pridobljene s CT slikanjem, so se izkazale za prognostične pri oceni tveganja za razvoj bolezni srca in ožilja pri asimptomatskih posameznikih. Protokoli za slikanje kalcinacij v koronarnih arterijah se razlikujejo. Za oceno kalcijevega bremena se najpogosteje uporablja Agatstonovo točkovanje. Naš namen je predstavitev različnih protokolov CT slikanja, kjer se upošteva faktorje pacienta in CT aparata. Z izbiro primernega CT protokola se optimizirata kvaliteta CT slik in doza na pacienta.

Metode: Za pisanje prispevka 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 2005 do 2024.

Rezultati: Rezultati pregleda literature kažejo, da lahko z optimizacijo CT protokola slikanja dosežemo do 20-krat nižjo dozo sevanja na pacienta. Koronarne arterije se premikajo glede na srčni utrip. Pri visokem srčnem utripu ne moremo prikazati vseh hkrati v istem območju srčnega utripa. Izbira protokola je odvisna od vrste in zmogljivosti CT aparata ter od srčnega utripa pacienta. Optimizirane protokole je mogoče implementirati na CT aparate različnih proizvajalcev.

Razprava in zaključek: Optimalno sestavljen CT protokol za slikanje koronarnih arterij za oceno kalcijevega bremena je ključnega pomena za oceno tveganja za nastanek srčnega infarkta. V Sloveniji je umrljivost zaradi bolezni srca in ožilja na tretjem mestu. Zaradi nizke doze sevanja in velike povedne vrednosti bi bila lahko metoda ocenjevanja kalcijevega bremena pri rizičnih, asimptomatskih posameznikih presejalna metoda.

Ključne besede: kalcijevo breme, CT protokol, optimizacija, doza

ABSTRACT

Introduction and purpose: Estimates of coronary artery calcium load, obtained by CT imaging, have been shown to be prognostic in assessing the risk of developing cardiovascular disease in asymptomatic individuals. Imaging protocols for coronary artery calcifications vary. Agatston scoring is the most commonly used method to assess calcium load. Our aim was to present different CT imaging protocols, where patient and CT scanner factors are taken into account. By choosing a suitable CT protocol, the quality of CT images and the patient dose are optimized.

Methods: We used the descriptive method of data collection to write the paper. Literature was obtained from databases such as Google Scholar, Cobiss+, PubMed and ScienceDirect. The timeframe of the literature search was set from 2005 to 2024.

Results: The results of the literature review showed that by optimizing the imaging protocol, we can achieve up to 20x lower patient dose. Coronary arteries move according to the heart rate. At a high heart rate, we cannot show them all at the same time in the same heart rate zone. The choice of protocol depends on the type and efficiency of the CT scanner, and on the heart rate of the patient. Optimized protocols can be implemented on CT devices from different vendors.

Discussion and conclusion: An optimally constructed CT protocol for coronary artery imaging to assess calcium load is crucial for the assessment of myocardial infarction risk. In Slovenia, mortality due to cardiovascular diseases ranks third. Due to its low radiation dose and high predictive value, the calcium load estimation method in at-risk, asymptomatic individuals could be a screening method.

Keywords: calcium load, CT protocol, optimization, dose

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PREDSTAVITEV PRIMERA: RADIOLOŠKA OBRAVNAVA PACIENTA S SKOLIOZO V ORTOPEDSKI BOLNIŠNICI VALDOLTRA

CASE REPORT: IMAGING OF SCOLIOSIS PATIENT AT THE VALDOLTRA ORTHOPAEDIC HOSPITAL

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IZVLEČEK

Uvod in namen: Namen prispevka je predstavitev radiološke obravnave pacienta s skoliozo od prvega ortopedskega pregleda do zaključka zdravljenja.
Metode: Pri delu smo uporabili deskriptivno metodo, podprto s primeri slik iz kliničnega okolja. Literaturo smo iskali v podatkovnih bazah, ki so bile dostopne na spletu z uporabo ključnih besed: skolioza, radiološka obravnava pacienta s skoliozo, *scoliosis imaging, scoliosis screening, scoliosis surgery*. V sodelovanju z zdravniki ortopedi, zaposlenimi v Ortopedski bolnišnici Valdoltra, smo dopolnili področja o kliničnih indikacijah za posamezne metode slikanja, pričakovanih rezultatih slikanja ter poteku obravnave skoliotičnega pacienta.
Rezultati: Radiološka obravnava spremlja paciente s sumom na skoliozo od prvega obiska pri zdravniku ortopedu v okviru priprave na operativno zdravljenje, perioperativno rentgensko slikanje ter rentgensko spremljanje pacienta po operativnem posegu. Predoperativno slikanje zajema: izvedbo klasičnega rentgenskega slikanja (osnovne in funkcionalne posnetke), magnetnoresonančnega slikanja (MR) celotne hrbtenice, nizkodozno računalniško tomografsko (CT) slikanje za pripravo operativnih pripomočkov (vodeno vstavljanje transpedikularnih vijakov). Med operacijo izvajamo diaskopsko spremljanje vstavljanja vijakov, po potrebi tudi 3D posnetke s pomočjo C-loka. Po operativnem posegu opravljamo kontrolna klasična rentgenska slikanja celotne hrbtenice.
Razprava in zaključek: Celostna obravnava in sodelovanje med radiološkim oddelkom in zdravniki ortopedi nam omogoča najugodnejše zdravljenje za pacienta pri zdravljenju skolioze. Vloga radiološkega inženirja je zelo pomembna tako pri izvedbi celotne slikovne diagnostike kot tudi med operativnim posegom in po samem posegu.
Ključne besede: skolioza, radiološka obravnava pacienta s skoliozo, rtg slikanje skolioze, CT slikanje skolioze, MR slikanje skolioze pred operativnih posegom

ABSTRACT

Introduction: The purpose of this paper is to present the routine screening for the diagnosis and evaluation of scoliosis, from the first orthopaedic examination to the end of patient treatment.
Methods: The descriptive method was used for the writing of this paper, while examples of images from clinical practice were included. Literature was sourced in databases available online using the following keywords: scoliosis, scoliosis imaging, scoliosis screening and scoliosis surgery. In collaboration with orthopaedic surgeons working at the Valdoltra Orthopaedic Hospital, we completed the sections on the clinical indications for each imaging modality, the expected imaging results and the management of the scoliotic patient.
Results: Radiological treatment follows patients with suspected scoliosis from the first visit to an orthopaedist , as part of preparation for surgery, perioperative X-ray imaging and X-ray imaging of the patient after surgery. Preoperative imaging includes the performance of traditional X-ray imaging (basic and specialized projections), magnetic resonance imaging (MRI) of the entire spine and low-dose computed tomography (CT) imaging for the preparation of operative devices (guided insertion of transpedicular screws). During the operation, we perform the diascopic monitoring of screw insertion, and if necessary, 3D images with the help of a C-arm. After the surgery, we perform postoperative X-ray imaging of the entire spine.
Discussion and conclusions: Comprehensive treatment and cooperation between the radiology department and orthopaedic doctors enables us to provide the most favourable treatment for the patient in the treatment of scoliosis. The role of the radiologic technologist is very important, both in the execution of the entire diagnostic imaging and during and after the surgery.
Keywords: scoliosis imaging, scoliosis screening, scoliosis surgery, X-ray guided transpedicular fixation

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VPLIV POLOŽAJA PACIENTOVIH ROK NA PRISOTNOST OKRNITVENEGA ARTEFAKTA PRI PET/CT PREISKAVAH

IMPACT OF THE POSITION OF A PATIENT'S ARMS ON THE OCCURRENCE OF TRUNCATION ARTIFACTS IN PET/CT IMAGING

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IZVLEČEK

Uvod in namen: V slikovni diagnostiki pogosto ugotavljamo pojav artefaktov, zaradi katerih je preglednost slike slabša. Artefakt je motnja slike, kjer je prikazana struktura, ki ni dejansko prisotna na predmetu, ki ga slikamo. Med zajemanjem podatkov pri pozitronski emisijski tomografiji/računalniški tomografiji (PET/CT) ima pacient med preiskavo roke nameščene nad glavo. V primerih, ko pacient ni zmožen namestiti rok nad glavo oziroma je zaradi klinične indikacije to potrebno, imajo pacienti med preiskavo roke ob telesu.
Namen raziskave je preveriti, ali obstajajo razlike v prisotnosti okrnitvenega artefakta v predelu komolcev na PET in CT slikah glede na položaj rok.
Metode: Izvedli smo primerjalno študijo. Spremenljivki, ki smo ju preverili sta prisotnost okrnitvenega artefakta na PET in CT sliki glede na položaj pacientovih rok. Podatke smo zbirali na Oddelku za nuklearno medicino Onkološkega inštituta Ljubljana. V analizo smo retrogradno vzeli priložnostni vzorec 104 pacientov z indeksom telesne mase med 25 kg/m^2 in 30 kg/m^2, ki so v letu 2023 opravili 18F-FDG (fluorodeoksiglukoza) PET/CT preiskavo celotnega telesa. Za vsako preiskavo smo naredili tri *postprocesing* rekonstrukcije v transverzalni ravnini, v predelu komolcev. Prisotnost artefaktov so nato ocenjevali trije specialisti nuklearne medicine s pomočjo programa ViewDex 3.0. Zbrane podatke smo s X^2 testom analizirali v programu SPSS Statistics 20.0. Pri testiranju raziskovalnih vprašanj smo upoštevali možnost napake 5 %.
Rezultati: Analiza podatkov je pokazala statistično značilen vpliv položaja rok na prisotnost okrnitvenega artefakta na PET (p=0,001) in CT (p≤0,001) slikah.
Razprava in zaključek: Prisotnost okrnitvenega artefakta je bila pri rokah, nameščenih ob telesu, v primerjavi z rokami, nameščenimi na pacientovem trebuhu, višja pri PET slikah za 39,54 % in pri CT slikah za 37,14 %.
Ključne besede: artefakti, položaj rok, PET/CT

ABSTRACT

Introduction and purpose: In imaging diagnostics, we often find the appearance of artifacts that can make the clarity of the image worse. Typically, PET/CT data acquisition takes place with the patient's arms placed above the head during the examination. In cases where the patient is unable to place their arms above their head or when it is necessary due to clinical indication, patients have their arms down.
The aim of the research was to check whether there are differences in the presence of a truncation artifact in the elbow area, depending on the arm position.
Methods: The empirical part comprises a comparative study. The variables that we checked in the research were the presence of a truncation artifact on the PET and CT image.
The data necessary for the research were collected at the Department of Nuclear Medicine of the Institute of Oncology Ljubljana. Retrospectively, we took a random sample of 104 patients with a body mass index between 25 kg/m^2 and 30 kg/m^2 who underwent a total body 18F-FDG (fluorodeoxyglucose) PET/CT examination in 2023. After accessing the data, we made three additional post-processing transverse plane reconstructions in the elbow area. The reconstructions were uploaded anonymously to the ViewDex 3.0 and evaluated by three nuclear medicine specialists. The collected data were analysed using the X^2 test in the SPSS Statistics 20.0. We also considered a 5% possibility of error.
Results: The data analysis showed the statistically significant impact of the position of a patient's arms on the occurrence of a truncation artifact on PET (p=0,001) and CT (p≤0,001) images.
Discussion and conclusion: The presence of a truncation artifact was higher in PET images by 39.54% and in CT images by 37.14% for arms placed next to the patient's body compared to arms placed on their abdomen.
Keywords: artifacts, arm position, PET/CT

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KOMUNIKACIJA Z UPORABNIKI RADIOLOŠKIH STORITEV

COMMUNICATION WITH USERS IN RADIOLOGY

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IZVLEČEK

Uvod in namen: Komunikacija (verbalna ali neverbalna) je osnovna človekova pravica, zahteva in potreba, tudi pri izvajanju radioloških storitev. Komunikacija mora biti na profesionalnem nivoju z upoštevanjem vseh strokovnih znanj in vedenj. Prav tako morajo izvajalci radioloških storitev, in še toliko bolj njihovi uporabniki, upoštevati objektivne in subjektivne občutke ter posebnosti posameznikov. S predstavitvijo in opisom načina komunikacije želimo podati usmeritve in priporočila glede ustrezne komunikacije, ne le zaradi boljšega sodelovanja in pridobivanja jasnih diagnostičnih in/ali terapevtskih rezultatov, temveč tudi v izogib nepotrebnim odklonom ali nerazumevanju pri vsakodnevnem strokovnem delovanju radioloških inženirjev z uporabniki.

Metode: Asertivnost je v SSKJ pomensko opredeljena kot trdno, odločno stališče. Hkrati je definirana kot odločno zastopanje sebe in svojih interesov, ob spoštovanju drugih. Komunikacija se ne nanaša zgolj na izmenjavo informacij, ampak vključuje tudi empatijo, poslušanje in razumevanje drugega. Asertivnost je oblika delovanja v socialnih interakcijah, ki omogoča izražanje občutij, želja, daje možnost pridobitve pravic, odbija nerazumne zahteve brez lastnega občutka strahu ali krivice in na način, ki ne povzroča psihološke ali fizične škode drugi osebi.

Rezultati: Uporabniki radioloških storitev, ki si v skladu z Ustavo RS in Zakonom o pacientovih pravicah (ZPacP) zaslužijo in so upravičeni do strokovne in spoštljive radiološke obdelave, so v neposredni interakciji z radiološkim inženirjem kot izvajalcem. Izvedene metode za predstavitev te teme so izkustvene narave, poročila o primerih, pridobljena iz vsakodnevne prakse radioloških inženirjev. Dragocen vir izkušenj ohranja in celo zahteva obnavljanje ter kontinuirano nadgradnjo dodatnih sposobnosti in znanj komunikacije za poklicno delovanje v vsakodnevni praksi.

Razprava in zaključek: Na rezultate opravljenih storitev, pridobljene z ustrezno komunikacijo, lahko vplivajo različni dejavniki, vendar se s pravilno in ustrezno komunikacijo vzpostavlja z uporabnikom radioloških storitev dober odnos sodelovanja in zaupanja, ki bistveno vpliva tudi na kakovost opravljenih storitev.

Ključne besede: Komunikacija, asertivnost, uporabnik radioloških zdravstvenih storitev, izvajalec radioloških storitev, radiološki inženir, radiologija, zdravstvena dejavnost, pravice in dolžnost

ABSTRACT

Introduction and purpose: Communication (verbal or non-verbal) is a basic human right, requirement and need, even in the provision of radiological services. Communication must always and in all cases be professional, taking into account all professional knowledge and behaviour, as well as the objective and subjective feelings of individual radiological service providers and, more importantly, users. Presenting and describing communication techniques facilitates improved cooperation and the acquisition of clear diagnostic and/or therapeutic results, as well as the avoidance of unnecessary deviations or misunderstandings in the daily professional work of radiological engineers with users.

Methods: Assertiveness is semantically defined as a firm, decisive position. A second explanation is psychological, and defines the decisive representation of oneself and one's interests, while at the same time respecting others. Communication is not only about the exchange of information; it also involves empathy, listening and understanding others. Assertiveness is therefore a form of action in social interactions that enables the expression of feelings and desires, and provides the possibility of obtaining rights, while rejecting unreasonable demands without a sense of fear or injustice, and in a way that does not cause psychological or physical damage to another person.

Results: Users of radiological services are entitled to professional and respectful medical or radiological treatment. They interact directly with the radiographer as a service provider. The implemented methods for the presentation of this topic are mainly experiential in nature, while 'case reports' were obtained from everyday practice. A valuable source of experience preserves and even requires the renewal and continuous upgrading of additional communication skills and knowledge to maintain professionalism in everyday practice.

Discussion and conclusion: The results obtained with appropriate communication can always be influenced by various factors. Through correct and appropriate communication, however, a good relationship of cooperation and trust can be established with the user of radiological services, which also significantly affects the quality of the services provided.

Keywords: communication, assertiveness, user of radiological health services, provider of radiological services, radiographer, radiology, health activity, rights and duties

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DIGITALNA SUBTRAKCIJSKA ANGIOGRAFIJA S CO_2

DIGITAL SUBTRACTION ANGIOGRAPHY WITH CO_2

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IZVLEČEK

Uvod in namen: Zaradi odsotnosti alergijskih reakcij in ledvične toksičnosti je CO_2 kot kontrastno sredstvo alternativa jodovi raztopini pri izvajanju digitalne subtrakcijske angiografije spodnjih okončin. Uvedba CO_2 v klinično prakso je bolnikom z zmanjšano ledvično funkcijo in prijavljeno alergijo na jodovo kontrastno sredstvo omogočila izvedbo minimalno invazivnega diagnostičnega in terapevtskega postopka.
Metode: S tem prispevkom bom predstavil prve izkušnje zaposlenih na Oddelku za klinično radiologijo Univerzitetnega kliničnega centra Republike Srbske v Banja Luki ter oceno kakovosti slik, pridobljenih med postopki, in njihovo primerjavo s slikami, pridobljenimi z jodovim kontrastnim sredstvom. Poleg ocene kakovosti pridobljene slike se bomo v prispevku osredotočili tudi na nekatere druge parametre, ki lahko vplivajo na izvedbo samega postopka. Ti parametri so: kakovost opacifikacije (motnosti) krvne žile s kontrastnim sredstvom, hitrost in praktičnost postopka, biološke lastnosti CO_2 in njegov vpliv na bolnika, združljivost z napravo ter ekonomska upravičenost.
Rezultati: Prednosti CO_2 so manjše tveganje za alergijske reakcije in nefrotoksičnost, možnost uporabe večje količine kontrasta v primerjavi z jodom, enaka tehnična zahtevnost uporabe kontrasta, medtem ko je negativna stran trenutno enaka ali morda manjša ekonomska donosnost. Povprečno trajanje diagnostičnega posega je bilo približno 20 minut, kar je enako kot pri uporabi joda in približno 20 % več od skupnega trajanja postopka pri uporabi joda pri angioplastiki.
Razprava in zaključek: CO_2 je varno in učinkovito kontrastno sredstvo in je ustrezna alternativa jodovi raztopini pri digitalni subtrakcijski angiografiji pri bolnikih, ki imajo kontraindikacije za njeno uporabo.
Ključne besede: CO_2, ogljikov dioksid, jodno kontrastno sredstvo, opacifikacija, digitalna subtrakcijska angiografija

ABSTRACT

Introduction and purpose: Due to the absence of allergic reactions and renal toxicity, CO_2, as a contrast medium, is an alternative to iodine contrast medium when performing digital subtraction angiography of the lower extremities. The introduction of CO_2 into clinical practice made it possible for patients with reduced renal function and a reported allergy to iodine contrast agent to undergo a minimally invasive diagnostic and therapeutic procedure.
Methods: Through this paper, I will present the initial experiences of the employees at the Department of Clinical Radiology of the University Clinical Centre of Republika Srpska, Banja Luka, and the evaluation of the quality of the images obtained during the procedures and their comparison with the images obtained using an iodine contrast medium. In addition to the evaluation of the quality of the obtained image, the paper will focus on some other parameters that can affect the performance of the procedure itself. These parameters are: the quality of the opacification of the blood vessel with the contrast agent, the speed and practicality of the procedure, the biological properties of CO_2 and how it affects the patient, compatibility with the device and economic profitability.
Results: The advantages of CO_2 are the reduced risk of allergic reactions and nephrotoxicity, the possibility of the application of a larger amount of contrast compared to iodine, the equal technical complexity of contrast application, while the negative side is currently a lower economic profitability. The average duration of diagnostic intervention was about 20 minutes, which is the same amount as in the application of iodine, and about 20% longer than the total duration of the procedure when using iodine when angioplasty is performed.
Discussion and conclusion: CO_2 is a safe and effective contrast agent and is an adequate alternative to iodine contrast agents in digital subtraction angiography in patients who have contraindications for its use.
Keywords: CO_2, carbon dioxide, iodine contrast agent, opacification, digital subtraction angiography

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VLOGA RADIOLOŠKEGA INŽENIRJA V HIBRIDNI OPERACIJSKI SOBI

ROLE OF THE RADIOGRAPHER IN A HYBRID OPERATING ROOM

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ABSTRACT

Introduction and purpose: The role of the radiographer in a hybrid operating room is to position the patient correctly and assist with the coronary angiography of a patient during open chest surgery. Other roles of the radiographers are to prepare the hybrid operating room, to assist the physician during catheter placement through the blood vessels and to provide support throughout the process. The procedure itself requires the collaboration of multiple professionals from various backgrounds, including echocardiography, anesthesia, perfusion, cardiothoracic surgery and interventional cardiology.

A 62 year-old man with aortic stenosis, a dilated ascending aorta and a prior inferior myocardial infarction with placement of one drug-eluting stent into the right coronary artery presented with worsening shortness of breath.

Methods: An echocardiogram confirmed the presence of severe aortic stenosis (aortic valve area of 0.6 cm^2) and dilated ascending aorta (60 mm). A repeated coronary angiogram showed significant in-stent restenosis in the right coronary artery, as well as new severe stenoses in the first obtuse marginal and first diagonal branches.

Results: The patient underwent an elective aortic valve replacement with a mechanical prosthesis, aortic reconstruction and coronary artery bypass grafting of the right coronary artery. The first diagonal and obtuse marginal branch were intraoperatively deemed small and poor bypass targets and were thus not grafted. Two hours after the surgery, while recovering in the intensive care unit, the patient suffered a cardiac arrest due to refractory ventricular fibrillation and was brought back to the hybrid operating room where additional grafts to the first diagonal and obtuse marginal branches were placed. The patient continued to be hemodynamically unstable with suspected ongoing ischemia, so a coronary angiogram was performed transfemorally while the chest was still open. It demonstrated patent grafts and the thrombotic occlusion of the left anterior descending artery (LAD) at the bifurcation with the first diagonal branch (Figure 1). This allowed for an additional left internal mammary bypass graft to be placed on the left anterior descending artery.

Unfortunately, the patient remained hemodynamically unstable and could not be weaned off the bypass machine. Ultimately, he was placed on extracorporeal membrane oxygenation (ECMO) and transferred to the intensive care unit.

Discussion and conclusion: In patients who have suspected ongoing ischemia after coronary artery bypass grafting, performing coronary angiogram in a hybrid operating room with ¸an open chest aids in the assessment of the functional status of the native arteries and bypass grafts, and provides real-time guidance of the management strategy. The role of the tehnician in proper patient positioning and obtaining adequate angles for angiography is essential.

Keywords: repeated coronary angiography, open chest, good position

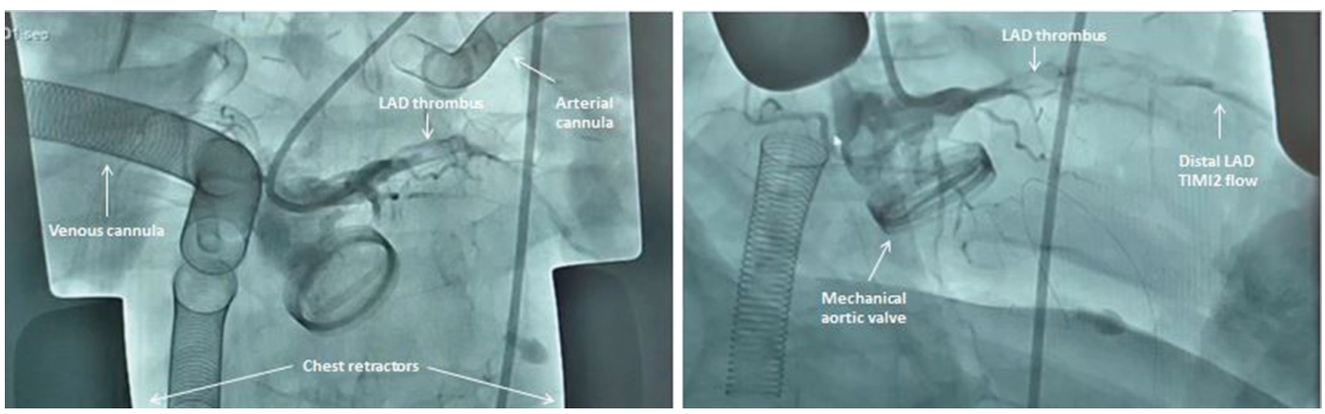

Figure 1

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NOSEČE RADIOLOŠKE INŽENIRKE IN DELO NA RADIOLOŠKIH DIAGNOSTIKAH

PREGNANT RADIOGRAPHERS AND WORK IN DIAGNOSTIC RADIOLOGY

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IZVLEČEK

Uvod in namen: Radiološke inženirke se v obdobju nosečnosti srečujejo z raznimi rizičnimi dejavniki, ki bi lahko ogrozili potek nosečnosti. To so na primer bolnišnične okužbe, stresni dejavniki, fizični napor ter ionizirajoča sevanja. To področje ureja Zakon o varstvu pred ionizirajočim sevanjem in jedrski varnosti, ki navaja, da je treba tako kot ostalim prebivalcem pozornost nameniti tudi plodu. Namen tega dela je predstaviti pogoje, pod katerimi delajo noseče radiološke inženirke na diagnostikah, zakonodajo, ki ureja to področje, in protokol po ugotovljeni nosečnosti.
Metode: Uporabili smo kvantitativno in kvalitativno metodo dela. Podatke smo zbirali s pomočjo spletnega anketnega vprašalnika, ki smo ga poslali članom ZDRI. Zanimali so nas le odgovori radioloških inženirk.
Rezultati: Večinoma so se na anketni vprašalnik odzvale radiološke inženirke, pri čemer je bilo približno 80 % anketirank že nosečih. Ugotovili smo, da je večina nosečih radioloških inženirk imela možnost odločanja o nadaljnjem delu na diagnostiki in skoraj vse so se odločile za delo brez ionizirajočega sevanja (administracija, arhivska dela, magnetna resonanca ipd.). Omenjeno možnost so izbrale iz preventivnih razlogov. O nosečnosti so nadrejene obveščale na različne načine, najpogosteje ustno. Enako kot noseče radiološke inženirke bi v enaki situaciji ravnale tudi radiološke inženirke, ki v času ankete še niso bile noseče.
Razprava in zaključek: V literaturi, ki smo jo preučili, so navedena priporočila, da je za nosečo radiološko inženirko najbolje, da nadaljuje delo brez izpostavljanja ionizirajočem sevanju. V skladu s pričakovanji so se oziroma bi se tako odločile tudi inženirke, ki smo jih anketirali. V Sloveniji se ne uporablja dodatnega dozimetra za merjenje doze, ki bi služila kot pomoč pri natančnejši oceni doze na plod. Možnost njegove uporabe je v literaturi omenjal Faulkner. Ugotovili smo tudi, da ni določeno, kako naj bi se sporočila informacija o nosečnosti. Naš predlog za prihodnost je, da bi se nadrejenim uredil sistem sporočanja nosečnosti, ki bi beležil tudi, kdaj je nadrejeni informacijo o nosečnosti prejel.
Ključne besede: nosečnost, ionizirajoče sevanje, izpostavljenost ploda, varstvo pred sevanjem, učinki ionizirajočega sevanja

ABSTRACT

Introduction and purpose: Pregnant radiographers are exposed to many risk factors, that could endanger the course of their pregnancy. The most common are hospital-acquired diseases, stress factors, physical work and ionising radiation. That last area is covered by the law governing radiation and nuclear safety, where it states that the care for an unborn child should be the same as for an adult person.
The purpose of this work was to present the conditions that pregnant radiographers work under, the law that governs this area of radiation safety and what is the protocol after the radiographer finds out she is pregnant.
Methods: We used quantitative and qualitative working methods. The information was gathered with the help of a survey in the form of a online questionnaire. The survey was sent to members of the Professional Association of Radiographers, but we were only interested in the answers of female radiographers.
Results: The majority of the answers were provided by female radiographers, 80% of who were previously pregnant at some point in time. We determined that most pregnant radiographers had the chance to make a choice about future work in diagnostics. Most of them made a choice to work at jobs without exposure to ionising radiation (administration, archive, magnetic resonance, etc.. They chose that option out of precaution. They informed their employers about their pregnancy in different ways, but most of them only did it verbally. Female radiographers that were not yet pregnant said that they would make the same choices as their pregnant co-workers.
Discussion and conclusion: In the literature we studied, we found some recommendations saying that it is best for a pregnant radiographer to continue work in a working place without exposure to ionising radiation. The majority of the surveyed pregnant radiographers chose that option, which was in line of our expectations. In Slovenia, we do not use an extra dosimeter that could be used for dose measurement to more accurately calculate dose that a foetus is exposed to. This option is mentioned by Faulkner in his work. We also determined that there are not any rules or laws that define how the information should be communicated to their employers. Our proposal for the future is the establishment of a system for informing employers about pregnancy and for receiving information from employer's side, in terms of documentation regarding the receipt of information, etc.
Keywords: pregnancy, ionising radiation, foetus exposure, radiation safety, effects of ionising radiation

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VLOGA RADIOLOŠKEGA INŽENIRJA V PRESEJALNEM PROGRAMU DORA IN PRI DIAGNOSTIČNI MAMOGRAFIJI

ROLE OF THE RADIOGRAPHER IN THE DORA SCREENING PROGRAM AND IN THE DIAGNOSTIC MAMMOGRAPHY SETTING

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IZVLEČEK

Uvod in namen: Na radiološkem oddelku izvajamo dve vrsti mamografij, presejalne in diagnostične, ki se med seboj razlikujejo. Namen prispevka je predstaviti delo radiološkega inženirja pri izvajanju presejalnih mamografij v okviru programa DORA in diagnostičnih mamografij v okviru ambulante za bolezni dojk.

Metode: Primerjali smo način dela radiološkega inženirja v programu DORA in pri diagnostični mamografiji. Primerjavo smo naredili glede na zahtevano izobraževanje za inženirje, delovni čas, sestavo kolektiva, standarde pozicioniranja, anamnezo z žensko, shranjevanje slik, način vabljenja, slikanje prsnih vsadkov ter nadzor kakovosti dela inženirja in mamografa.

Rezultati in razprava: V programu DORA obravnavamo na videz zdrave ženske brez znakov bolezni dojk, na diagnostično mamografijo pa pridejo ženske z znaki in simptomi. Kakovost dela radiološkega inženirja v programu DORA se ocenjuje redno na letni ravni, v diagnostiki pa se kakovost dela ne ocenjuje. Zahteva se najmanj 75 % odličnih mamografskih slik. Izobraževanje za delo v programu DORA poteka tri dni za teoretični del in dva tedna za praktični del – pozicioniranje. Dodatnega izobraževanja v diagnostični mamografiji ni. Ženska je v program DORA aktivno vabljena z osebnim vabilom tri tedne pred datumom mamografije vsake dve leti od 50. do 69. leta. Pri diagnostični mamografiji pa ženska najprej pridobi napotnico iz ambulante za bolezni dojk ali od splošnega zdravnika in se potem sama naroči. Prihajajo ženske vseh starosti in tudi moški.

Zaključek: Pogoj za delo v programu DORA je opravljeno dodatno izobraževanje inženirja, medtem ko v diagnostični mamografiji inženir lahko začne delati po opravljenem pripravništvu. V programu DORA poteka redno letno ocenjevanje kakovosti dela inženirjev. Potek dela v programu DORA je nadzorovan na vsakem koraku presejanja, saj je za uspeh programa ključna udeležba žensk, ki pričakujejo kakovostno obravnavo.

Ključne besede: Presejalna mamografija, DORA, ocenjevanje, izobraževanje, diagnostična mamografija, radiološki inženir

ABSTRACT

Introduction and purpose: The radiology department performs two types of mammograms: screening and diagnostic. The purpose of this paper is to present the work of a radiographer in performing screening (in the DORA programme) and diagnostic mammography (in the centre for breast diseases).

Methods: We compared a radiographer's work in the DORA program and in diagnostic mammography, in terms of the required education for radiographers, working hours, the composition of the team, positioning standards, women's medical history, the archiving of images, inviting, the imaging of breast implants and control over the quality of a radiographer's work and mammographs.

Results: In the screening, asymptomatic women were assessed, while women with breast disease symptoms were assessed using diagnostics. The quality of the radiographer's work in the DORA programme is assessed annually, while the quality of work is not assessed in diagnostics. At least 75% of excellent mammograms are required. Training in DORA takes three days for theory and two weeks for practice–positioning. Additional training for performing diagnostic mammography is not required. Woman are invited to the screening programme via a personal invitation letter, three weeks before the term, every two years from 50 – 69 years of age. For diagnostic mammography, however, a woman first obtains a referral from a breast clinic or a general practitioner, and then makes an appointment herself. Patients are women of all ages, as well as men.

Discussion and conclusion: Additional training is required to work in the DORA programme, but not in diagnostic mammography. DORA assesses the work of radiographers annually. The DORA programme is monitored at every step of screening, as the participation of women who expect high quality treatment is key to the success of the programme.

Keywords: Screening mammography, DORA, assessment, education, diagnostic mammography, radiographer

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GIBANJE DANKE MED NEOADJUVANTNIM OBSEVANJEM PRI BOLNIKIH Z RAKOM DANKE

MOTION OF THE RECTUM DURING NEOADJUVANT IRRADIATION AT THE PATIENTS WITH RECTAL CANCER

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IZVLEČEK

Uvod / namen: Danka in mezorektum sta gibljivi strukturi zaradi peristaltike ali različne napolnjenosti sečnega mehurja, kar je treba obvezno upoštevati kot gibanje organov. Hiter in učinkovit razvoj slikovne tehnologije je omogočil vstop v svet adaptivne radioterapije (ART), ki nam omogoča prilagajanje spremembam položaja tarčnih volumnov. Namen raziskave je bil pridobiti celovit vpogled v gibanje danke v zgornji, srednji in spodnji tretjini in preučiti potrebo po vzpostavitvi ART.

Metode: V raziskavo smo vključili 50 predoperativno obsevanih bolnikov. Izvedbo raziskave smo razdelili na štiri dele: pregled baze podatkov, vrisovanje anatomskih struktur, zbiranje podatkov odstopanj in izpis podatkov, kjer smo ločeno izvajali poravnavo na kostne strukture – križnico in poravnavo na zadnjo steno danke.

Rezultati: Največje odstopanje je bilo izraženo v zgornji, sledila je srednja in nato spodnja tretjina danke. Analiza je pokazala, da so pri poravnavi na kostne strukture – križnico statistično značilne razlike v vertikalni in lateralni smeri, medtem ko so pri poravnavi na zadnjo steno danke statistično značilne razlike v lateralni smeri.

Razprava in zaključek: Položaj danke v zgornji, srednji in spodnji tretjini se vsakodnevno spreminja pri poravnavi na kostne strukture – križnico, kot tudi pri poravnavi na zadnjo steno danke. S pridobljenimi rezultati smo prikazali, da je danka organ, ki zaradi gibanja potrebuje uporabo ART, saj na njeno napolnjenost nimamo vpliva. Z zagonom ART v Sloveniji bi zdravljenje onkoloških bolnikov s karcinomom danke dvignili na višjo raven in zagotovili boljše in natančnejše zdravljenje.

Ključne besede: rak danke, gibanje danke, neoadjuvantna radioterapija, adaptivna radioterapija

ABSTRACT

Introduction and purpose: Rectum and mesorectum are dynamic structures affected by peristalsis or varying bladder filling, and these factors must be considered as organ motion. The rapid development of imaging guided technology has facilitated the emergence of adaptive radiotherapy (ART), allowing adaptation to change in the position to target volumes. The aim of this research was to obtain comprehensive insight into the motion of the rectum in the upper, middle, and lower third, and assess the need for the implementation of ART.

Methods: Fifty preoperatively irradiated patients were included in the study. The research was divided into four main parts: database review, the drawing of anatomical structures, data collection of deviations and data output, where alignment to bone structures – the sacrum and alignment to the posterior rectal wall – were performed separately.

Results: The greatest deviation was expressed in the upper, followed by the middle and then the lower third of the rectum. The analysis revealed that there are statistically significant differences in vertical and lateral direction when aligning to bone structures – sacrum, while when aligning to the posterior rectal wall, there are statistically significant differences in the lateral direction.

Discussion and conclusion: The position of the rectum in the upper, middle, and lower thirds changes daily in alignment with bone structures – sacrum, and in alignment with the posterior rectal wall. The obtained results demonstrate that the rectum requires ART as a highly movable organ with no control over its filling. Implementing ART in Slovenia would elevate the treatment of rectal cancer patients to a higher standard, ensuring better and more precise treatment.

Keywords: rectal cancer, rectal motion, neoadjuvant radiotherapy, adaptive radiotherapy

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DISEKCIJA AORTE: PREGLED SLIKOVNIH METOD IN SMERNIC

AORTIC DISSECTION: OVERVIEW OF IMAGING METHODS AND GUIDELINES

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IZVLEČEK

Uvod in namen: Disekcija aorte je potencialno življenjsko ogrožajoče stanje, pri katerem pride do razslojitve žilne stene aorte. S tem je omogočen pretok po prvotnem in dodatnem, t. i. lažnem volumnu žile. Disekcije ločimo glede na mesto njihovega nastanka. Po Stanfordski klasifikaciji Tip A vključuje disekcijo ascendentne aorte, medtem ko tip B ne vključuje prizadetosti ascendentne aorte. Ključnega pomena je prepoznavanje znakov, med katere spada huda prsna bolečina, ki se širi vzdolž disekcije. Z različnimi diagnostičnimi postopki moramo potrditi diagnozo, opredeliti mesto disekcije, prizadetost vej aorte ter morebitno prizadetost koronarnih arterij. Računalniška tomografija in magnetnoresonančno slikanje sta glavni tehniki slikanja pri diagnosticiranju in spremljanju disekcije aorte. Namen članka je pregled literature in predstavitev tehničnih izzivov pri diagnosticiranju disekcije aorte.

Metode: Uporabljena je bila deskriptivna metoda in metoda pregleda literature. S pomočjo spletnega brskalnika dLib, Google učenjak in PubMed Central sem iskala slovenske in tuje članke s ključnimi besedami disekcija aorte, diagnosticiranje, računalniška tomografija.

Rezultati: Računalniška tomografija in magnetnoresonančno slikanje omogočata dobro prostorsko in kontrastno ločljivost slik in s tem natančnejšo oceno aorte. Protokoli diagnosticiranja z računalniško tomografijo predlagajo slikanje nativne oz. brezkontrastne faze, ki ji sledita arterijska ter pozna faza celotne aorte. Priporoča se uporaba tehnike slikanja z elektrokardiogramom, ki zagotavlja slike z manj artefakti pulziranja srca in aorte. Pozno fazo slikanja izvedemo, ko pričakujemo ishemijo organov ali okončin, ki so izključeni iz krvnega obtoka. Alternativa računalniški tomografiji pri spremljanju kronične disekcije je magnetnoresonančno slikanje, ki ima prednost v meritvi pretoka aorte in odsotnosti ionizirajočega sevanja.

Razprava in zaključek: Dokazovanje disekcije zahteva hitre in natančne diagnostične postopke. Pomembno je slediti smernicam in priporočilom, ki nas opozarjajo na morebitne težave pri izvedbi preiskav in nas usmerjajo k čim bolj kakovostnim diagnostičnim slikam.

Ključne besede: disekcija aorte, diagnosticiranje, računalniška tomografija

ABSTRACT

Introduction and purpose: Aortic dissection is a potentially life-threatening condition in which there is a separation of the vascular wall of the aorta. This enables blood flow both within the original and an additional, so-called false lumen of the vessel. Dissections are classified based on the location of their origin. According to the Stanford classification, Type A involves dissection of the ascending aorta, while Type B does not involve dissection of the ascending aorta. It is crucial to recognize signs such as severe chest pain that radiates along the dissection. Various diagnostic procedures are required to confirm the diagnosis, determine the site of the dissection, the involvement of aortic branches, and the possible impairment of coronary arteries. Computed tomography and magnetic resonance imaging are the main imaging techniques for diagnosing and monitoring aortic dissection. The purpose of this article is to review existing literature and present the technical challenges in diagnosing aortic dissection.

Methods: A descriptive and literature review method was used. Using the dLib online platform, Google Scholar, and PubMed Central, I searched for Slovenian and foreign articles using keywords such as aortic dissection, diagnosis, and computed tomography.

Results: Computed tomography and magnetic resonance imaging provide excellent spatial and contrast resolution, allowing for a more precise assessment of the aorta. Protocols for diagnosing with computed tomography suggest imaging in native or non-contrast phases, followed by arterial and late phases of the entire aorta. The use of electrocardiogram-gated imaging techniques is recommended to provide images with fewer artifacts from heart and aortic pulsations. Late-phase imaging is performed when ischemia of organs or limbs excluded from blood flow is expected. Magnetic resonance imaging serves as an alternative to computed tomography in monitoring chronic dissection, offering the advantage of measuring aortic flow and avoiding ionizing radiation.

Discussion and conclusion: Detecting aortic dissection requires rapid and accurate diagnostic procedures. It is important to adhere to guidelines and recommendations that alert us to potential challenges in performing examinations and guide us towards obtaining the highest quality diagnostic images possible.

Keywords: aortic dissection, diagnosis, and computed tomography

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INTRAVENSKA UPORABA SPAZMOLITIKOV MED PREISKAVO MEDENICE Z MAGNETNO RESONANCO

INTRAVENOUS USE OF SPASMOLYTICS DURING MAGNETIC RESONANCE EXAMINATION OF THE PELVIS

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IZVLEČEK

Uvod in namen: MR preiskava medenice se pogosto uporablja v vsakdanji klinični praksi in je postala rutinski diagnostični postopek. Med slikanjem z MR se neizogibno pojavlja veliko različnih vrst artefaktov. Razdelimo jih lahko na artefakte, ki jih povzroči bolnik, in artefakte, povezane z zaporedjem MR. Za zmanjšanje peristaltičnih artefaktov se intravensko aplicirajo antiperistaltična sredstva (spazmolitiki). V radiološki praksi v Evropi se najpogosteje uporablja Buscopan, ki deluje spazmolitično (hioscinijev butilbromid, HBB).

Metode: Klinična prospektivna študija z randomiziranim kontroliranim preskušanjem. Raziskava je bila izvedena v Univerzitetnem kliničnem centru v Banja Luki. Obdobje raziskave je trajalo od marca do junija 2023. Preučevani vzorec so sestavljali bolniki, napoteni na MR preiskavo medenice. V raziskavo je bilo vključenih 60 preiskovancev; 30 žensk in 30 moških. Magnetnoresonančne preiskave za raziskavo so bile opravljene na MR napravi 1,5 Magnetom Avanto Fit (Siemens Ag 2015, Erlangen, Nemčija) z uporabo 18-kanalne tuljave za telo in 32-kanalne tuljave za hrbtenico. Uporabljen je bil standardni protokol, ki se uporablja za preiskave medenice. V tem protokolu so bile uporabljene standardne sekvence T2W FSE (ang. *fast spin echo*) v transverzalni, koronalni in sagitalni ravnini, sekvence T1W z in brez nasičenja maščobe (FS) v transverzalni ravnini, sekvenca DWI v transverzalni ravnini (difuzijsko obteženo slikanje) in T1W FS v transverzalni, koronalni in sagitalni ravnini po uporabi kontrastnega sredstva. Za zmanjšanje peristaltičnih artefaktov med magnetno resonanco medenice je priporočljivo neposredno pred začetkom preiskave intravensko odmeriti 2 ml Buscopana (40 mg HBB). Klinični učinki Buscopana so kratkotrajni, normalna črevesna peristaltika pa se vzpostavi od 15 do 40 minut po odmerku. Predvideno skupno trajanje MR preiskave je približno 25 minut.

Rezultati: Raziskava je pokazala, da intravensko apliciranje spazmolitikov zmanjša peristaltične artefakte, prispeva k izboljšanju splošne kakovosti slike pri MR preiskavi medenice ter ne vpliva na trajanje MR preiskave.

Razprava in zaključek: Uporaba spazmolitikov vodi k zmanjšanju peristaltičnih artefaktov, s čimer se poveča splošna kakovost slike, medtem ko ne vpliva na trajanje preiskave in ne povzroča neželenih reakcij.

Ključne besede: magnetna resonanca, medenica, Buscopan, artefakt

ABSTRACT

Introduction: MR examination of the pelvis is widely used in everyday clinical practice and has become a routine diagnostic procedure. Many different types of artifacts inevitably occur during MR imaging. They can be categorized as patient-induced artifacts and MR sequence-related artifacts. In order to reduce peristaltic artifacts, antiperistaltic agents (spasmolytics) are administrated intravenously. The most commonly used antispasmodic in radiological practice in Europe is Buscopan (hyoscine N-butylbromide(HBB)).

Methods: Clinical prospective study randomized controlled trial. The research was conducted at the University Clinical Centre of Banja Luka. The research period was from March to June 2023. The examined sample consisted of patients referred for an MR examination of the pelvis. The study included 60 respondents (30 female and 30 male). MR examinations for the study were performed on a 1.5 Magnetom Avanto Fit MR system (Siemens Ag 2015, Erlangen, Germany) using both an 18-channel body coil and a spine 32-channel coil. The protocol used to perform this examination was the standard protocol used for pelvic examinations. Used in this protocol were standard T2W FSE (fast spin echo) sequences in transversal, coronal and sagittal planes, T1W sequences with and without fat saturation (FS) in a transversal plane, DWI sequence in a transversal plane (diffusion weighted imaging) and T1W FS in transversal, coronal and sagittal planes after contrast agent. In order to reduce peristaltic artifacts during pelvic MRI, it is recommended to administer 2 ml of Buscopan (40 mg HBB) intravenously, immediately before the start of the examination. The clinical effects of Buscopan are short-lived, while normal intestinal peristalsis is established between 15 and 40 minutes after administration. The expected total duration of the MR examination is approximately 25 minutes.

Results: This research showed us that the intravenous administration of spasmolytics reduces peristaltic artifacts and contributes to an increase in the overall quality of the image in an MR examination of the pelvis, and that the administration of spasmolytics has no effect on the time of an MR examination.

Conclusion: The use of spasmolytics leads to a reduction in peristaltic artifacts, thereby increasing the overall quality of the image, while it does not affect the examination time and cause unwanted reactions.

Keywords: magnetic resonance, pelvis, Buscopan, artifact

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OBSEVANJE CELEGA TELESA PRI PEDIATRIČNIH BOLNIKIH V SEDACIJI

TOTAL BODY IRRADIATION IN SEDATED PAEDIATRIC PATIENTS

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IZVLEČEK

Uvod in namen: Obsevanje celega telesa je posebna obsevalna tehnika v radioterapiji, ki se uporablja skupaj z intenzivno kemoterapijo pri bolnikih z levkemijo ali malignim limfomom pred presaditvijo kostnega mozga ali krvotvornih matičnih celic. Namen je predstaviti pripravo na obsevanje celega telesa, izvedbo narisa pljučnih polj za zaščito pljuč in obsevanje pri pediatričnih bolnikih v sedaciji.

Metode dela: Priprava na obsevanje se izvede na računalniško tomografskem simulatorju (CT simulator) v sodelovanju s pediatričnim oddelkom za hematologijo in timom iz oddelka za anestezijo, ki bolnika intubira z žičnatim tubusom, saj bolnik med pripravo na obsevanje in med obsevanjem leži ne samo v anteroposteriornem, ampak tudi v posteroanteriornem položaju. CT slikanje zajema prsni koš nad apeksi pljuč do vključno 2 cm pod celotno prepono. Uporabimo protokol CT slikanja za prsni koš.

Rezultati: Medicinski fizik izmeri bolnikovo dolžino od roba temena do konca prstov na nogah ter debelino bolnika s kljunastim merilom v predelu popka in podatke zabeleži na obsevalni karton za izračun hitrosti pomika mize in obsevalne doze. Zdravnik radioterapevt vrisuje v sistemu za načrtovanje zaščito za pljuča. Sledi naris pljučnih polj na bolnikovo kožo na linearnem pospeševalniku dva dni po pripravi bolnika na CT simulatorju. Nato se izdelajo individualne zaščite za pljuča iz Woodove zlitine. Pred obsevanjem bolnika s fotonskimi žarki energije 6 MV se postavi poseben sistem pomične mize.

Razprava in zaključek: Bolnika se med obsevanjem (6 dni, zjutraj in zvečer z dozo 2 Gy na frakcijo s skupno tumorsko dozo 12 Gy) vzdržuje v rahli sedaciji, saj bi z ekstubiranjem preveč poškodovali sluznico dihalnih poti. Celotna izvedba postopkov zahteva dobro sodelovanje in koordinacijo med vsemi člani timov. V skladu z novimi smernicami zdravljenja smo od leta 2021 na radioterapevtskem oddelku Onkološkega inštituta v Ljubljani obsevali 2 pediatrična bolnika v sedaciji.

Ključne besede: Obsevanje celega telesa, pediatrični bolniki v sedaciji, načrtovane individualne zaščite

ABSTRACT

Introduction: Total body irradiation is a special radiation therapy technique used in combination with intensive chemotherapy in patients with leukaemia or malignant lymphoma prior to bone marrow or hematopoietic stem cell transplantation. The aim is to present the preparation for total body irradiation, the performance of lung field drawing for lung protection and irradiation in paediatric patients under sedation.

Methods: The preparation for irradiation is performed using a computed tomography simulator (CT simulator) in collaboration with the paediatric haematology department and the anaesthesia team, who intubate the patient with a wire-reinforced tube. This is necessary as the patient is positioned not only in the anteroposterior position during both the preparation for irradiation and the irradiation itself, but also in the posteroanterior position. The CT scan covers the chest area from above the lung apices to at least 2 cm below the entire diaphragm. The standard CT imaging protocol for the chest is used.

Results: The medical physicist measures the patient's length from the edge of their temple to the tip of the toes, and their thickness at the navel using a calliper. These measurements are recorded on the irradiation chart to calculate both the table feed rate and the irradiation dose. The radiotherapist subsequently contours the lung shielding in the planning system. This is followed by drawing the lung fields on the patient's skin on the linear accelerator two days after preparing the patient on the CT simulator. Individual Wood's alloy lung shields are then made. Before irradiation, a specialised sliding table system is set up, and is designed for the total body irradiation of patients using photon beams with an energy of 6MV.

Discussion and conclusion: The patient is kept lightly sedated during the radiation treatment (6 days, morning and evening, at a dose of 2 Gy per fraction with a total tumour dose of 12 Gy), as extubation would cause too much damage to the mucous membranes of the respiratory tract. The overall performance of the procedures requires good cooperation and coordination between all team members. In accordance with the updated treatment guidelines established in 2021, two paediatric patients have undergone irradiation under sedation within the radiotherapy department of the Ljubljana Institute of Oncology.

Keywords: total body irradiation, paediatric patients under sedation, planned individual shields

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PREDOPERATIVNO SLIKANJE KOLENA Z MARKERJEM

PREOPERATIVE IMAGING OF THE KNEE WITH A MARKER

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IZVLEČEK

Uvod in namen: Predoperativno slikanje kolena z markerjem vključuje slikanje kolena v anteroposteriorni in stranski projekciji ter slikanje spodnje okončine na dolgi film. Pri slikanju uporabljamo napravo VoyantMark z enotno označevalno kroglico iz nerjavečega jekla, ki omogoča kalibracijo in označevanje kosti.
Namen plakata je predstavitev protokola za predoperativno slikanje kolena z markerjem v Splošni bolnišnici Murska Sobota.
Metode: Pregledali smo literaturo, ki zajema opis in način uporabe markerja, ter predstavili protokol slikanja, ki ga uporabljamo v naši bolnišnici.
Rezultati: Pred vsako operacijo kolena, pri kateri je potrebna vstavitev endoproteze, imamo vnaprej določen protokol slikanja. Slikanje vključuje slikanje kolena v anteroposteriorni in stranski projekciji, ki se izvedeta na razdalji 115 cm, ter slikanje spodnjih okončin na dolgi film, ki se izvede na razdalji 300 cm. Slikanje kolena opravimo stoje pri stenskem stativu, pri čemer mora biti teža enakomerno razporejena na obe nogi. Slikanje spodnje okončine na dolgi film vključuje obe nogi od medenice do gležnja na enem filmu. Obe spodnji okončini sta usmerjeni tako, da je vsaka pogačica obrnjena naprej in sta koleni maksimalno iztegnjeni. S pomočjo te slike lahko zdravnik določi os okončine in opravi meritve, potrebne za načrtovanje vstavitve endoproteze. Pri vseh slikah dodamo napravo VoyantMark s kroglico, ki jo namestimo v višino kolenskega sklepa. Kroglica je iz nerjavečega jekla s premerom 25,4 mm in omogoča kirurgom natančen izračun rentgenske povečave. Marker je zasnovan posebej za delo s programsko opremo za kirurško načrtovanje TraumaCad. TraumaCad nato samodejno zazna prisotnost VoyantMark na sliki in natančno določi velikost slike.
Razprava in zaključek: Prednosti uporabe naprave VoyantMark je enostavna namestitev, kjer s prilagodljivo roko nastavimo kroglico v nivo sklepa. S pomočjo tega markerja lahko TraumaCad zagotovi natančno merjenje anatomije in pomaga izbrati ustrezen protetični pripomoček pred operacijo.
Ključne besede: marker, koleno, dolgi film

ABSTRACT

Introduction: Preoperative knee imaging with a marker involves capturing images of the knee in anteroposterior and lateral projections, as well as imaging the lower limb on a long film. The VoyantMark device with a single stainless steel marker ball is utilized for imaging, enabling calibration and bone marking.
The purpose of this poster is to present the protocol for preoperative knee imaging with a marker at the General Hospital Murska Sobota.
Methods: We reviewed literature covering the description and usage of the marker, and presented the imaging protocol employed at our hospital.
Results: Prior to every knee operation requiring endoprosthesis insertion, we adhere to a predetermined imaging protocol. Imaging comprises capturing anteroposterior and lateral knee projections at a distance of 115 cm, and imaging the lower limbs on a long film at a distance of 300 cm. Knee imaging is performed standing at the wall-mounted stand, ensuring even weight distribution on both legs. Lower limb imaging on the long film includes both legs from pelvis to ankle on a single film. Both lower limbs are positioned with each patella facing forward and knees maximally extended. This image aids the physician in determining limb alignment and conducting measurements necessary for endoprosthesis insertion planning. In all images, the VoyantMark device with a ball is added, positioned at the level of the knee joint. The ball is made of stainless steel with a diameter of 25.4 mm, facilitating precise calculation of radiographic magnification for surgeons. The marker is specifically designed for use with TraumaCad surgical planning software. TraumaCad automatically detects the presence of VoyantMark in the image and accurately determines the image size.
Discussion and Conclusion: The advantages of using the VoyantMark device include easy installation, where the ball is adjusted to joint level with a flexible arm. With this marker, TraumaCad can ensure precise measurement of anatomy and aid in selecting the appropriate prosthetic device preoperatively.
Keywords: marker, knee, long film

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THE ROLE OF IMAR ITERATIVE RECONSTRUCTION SOFTWARE IN THE REDUCTION OF METAL ARTIFACTS AND IMAGE QUALITY

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ABSTRACT

Introduction: Computed tomography is an indispensable diagnostic radiological method that is used daily in clinical practice. The modern design of new devices used today has led to a partial reduction of artifacts in CT images. Artifacts in radiology refer to any difference between the CT count on the image and the actual radiation attenuation in the object. A significant contribution to the scanning of structures with implants, artificial joints and pacemakers was made possible through the use of iMAR, the primary role of which is to obtain an image with a reduced level of metal artifacts in use with conventional reconstruction if the CT data is distorted by metal.

Methods: Used in this paper were data obtained from the analysis and review of available scientific and professional papers in the database, as well as data from the archives of the Institute of Clinical Radiology and images archived through the available PACS system.

Results: Using the data, I will show and explain in this paper the impact of iterative iMAR reconstruction using a Siemens TwinBeam Dual Energy technology, which can be combined with the iMAR algorithm to reduce metal artifacts.

Conclusion: Based on the collected data, the subjective quality of the image was significantly improved, and the artifacts caused by metal implants were significantly reduced. The most important factors for avoiding image artifacts remain precise positioning and the proper preparation of the patient.

Keywords: CT, iMAR, metal artifacts.

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CT KORONAROGRAFIJA – POMEN CT KORONAROGRAFIJE V DIAGNOSTIKI BOLEZNI SRCA IN OŽILJA

CT CORONAROGRAPHY – IMPORTANCE OF CT CORONAROGRAPHY IN THE DIAGNOSIS OF CARDIOVASCULAR DISEASES

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IZVLEČEK

Uvod: Bolezni srca in ožilja so danes v razvitih državah eden glavnih vzrokov umrljivosti. Za diagnosticiranje bolezni srca in ožilja se kot zlati standard uporablja DSA. Izjemen razvoj CT z zmanjšanjem doze sevanja je privedel do tega, da se CT koronarografija, t.i. koronarna angiografija, vse pogosteje uporablja kot neinvazivna preiskava za oceno koronarnih arterij.
Metode: V tem prispevku bomo opisali način delovanja CT koronarografije, njen pomen pri diagnostiki srčno-žilnih bolezni, pripravo bolnikov na to preiskavo ter prednosti in slabosti te vrste diagnostike srčno-žilnih bolezni v primerjavi z drugimi diagnostičnimi metodami. Prikazali bomo tudi nekaj zanimivih primerov, opravljenih na napravi Siemens Somatom Definition Edge.
Rezultati: Na Inštitutu za klinično radiologijo UKC RS je bilo od 10. aprila 2022 do danes v omenjenem postopku z napravo Siemens Somatom Definition Edge uspešno opravljenih 600 preiskav.
Razprava in zaključek: Na podlagi navedenega lahko sklepamo, da postaja CT koronarografija vse bolj priljubljena in zelo uporabna metoda za odkrivanje bolezni srca. Gre za obetavno tehniko, ki jo morajo izvajati izkušeni operaterji. Njeni klinični rezultati so zelo odvisni od optimizacije vsakega koraka postopka.

ABSTRACT

Introduction: Cardiovascular diseases are one of the leading causes of mortality in developed countries today. For the diagnosis of cardiovascular diseases, DSA is used as the gold standard. However, the exceptional development of CT, with the reduction of the radiation dose, has led to the fact that CT coronary angiography is increasingly used as a non-invasive examination for assessing coronary arteries.
Methods: In this paper, we will describe the working method of CT coronary angiography itself, its importance in the diagnosis of cardiovascular diseases, the preparation of patients for this examination, and the advantages and disadvantages of this type of diagnosis of cardiovascular diseases in relation to other diagnostics. We will also show a couple of interesting cases performed on the Siemens Somatom Definition Edge device.
Results: From April 10, 2022, 600 examinations have been successfully performed at the Institute for Clinical Radiology, UKC RS to date, in the mentioned procedure using the Siemens Somatom Definition Edge device.
Conclusion: We can conclude from the above that CT coronary angiography is becoming an increasingly popular and very useful method for detecting heart diseases. It is a promising technique that should be performed by experienced operators. Its clinical results are highly dependent on the optimization of each step of the procedure.

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UPORABA UMETNE INTELIGENCE PRI OCENI KOSTNE STAROSTI V OTROŠKEM OBDOBJU

USE OF ARTIFICIAL INTELLIGENCE IN ASSESSMENT OF BONE AGE IN CHILDHOOD

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IZVLEČEK

Uvod in namen: Ocena kostne starosti pri otrocih je merilo stopnje zrelosti/razvoja skeleta v primerjavi z zrelostjo skeleta določeno za kronološko starost otroka. Izračunamo jo s pomočjo rentgenske slike leve roke in zapestja, slikanega v posteriorno-anteriorni projekciji. Določanje le-te je sprva potekalo ročno, z razvojem umetne inteligence pa se je pojavilo več avtomatiziranih metod. Od leta 2016 v klinični praksi na Pediatrični kliniki v UKC Ljubljana uporabljamo računalniški program BoneXpert. Namen prispevka je na primeru predstaviti proces ocenjevanja z ročnim izračunom in z avtomatiziranim izračunom.

Metode: Pri ocenjevanju kostne starosti po klasični metodi s pomočjo atlasa radiolog primerja točno določena skeletna področja na rentgenskem posnetku z enakimi področji na najbolj primerljivih referenčnih slikah, ki so zbrane v Greulich-Pyle atlasu. V slednjem so le-te ločene po spolu: pri fantih so slike razporejene od 0–18 let, pri dekletih pa od 0–19 let, v intervalih od treh mesecev do enega leta. Program BoneXpert pa deluje na podlagi strojnega učenja ter analizira sam in omogoča oceno kostne starosti za dečke v starostnem obdobju od 2,5–19 let in za deklice od 2–18 let. Končni rezultat je rentgenska slika z dodanimi vrednostmi izračuna, ki se kot datoteka DICOM v bolnišničnem PACS-u shrani v isti mapi kot izvorna rentgenska slika.

Rezultati: Pri deklici z normalno skeletno morfologijo smo prikazali izračun programa BoneXpert in opisali izračun kostne starosti z atlasom brez vrednosti: kronološka starost deklice je 7.88 let, v Greulich-Pyle vrednosti je 8.32 let in 8.28 let po Tanner-Whitehouse stopnji. Ročni izračun ni potreben zaradi normalnega skeleta.

Razprava in zaključek: BoneXpert skrajša čas do izvida ob normalni morfološki sliki kosti. V kliničnem okolju je pomembno, da radiolog prepozna v katerih situacijah analiza s pomočjo programa BoneXpert ni smiselna in uporabi ročni izračun. Človeški faktor pri procesu določanja kostne starosti ostaja ključen.

Ključne besede: pediatrija, kostna starost, radiologija, umetna inteligenca, BoneXpert

ABSTRACT

Introduction and purpose: Evaluation of bone age in children is a measure of skeletal maturity/development compared to the skeletal maturity determined for the chronological age of the child. It is calculated using a radiograph of the left hand with wrist in posterior-anterior projection. Initially, the bone age was determined manually, but with the development of artificial intelligence, several automated methods have emerged. Since 2016, the Pediatric Clinic at the University Medical Centre Ljubljana has been using the BoneXpert computer program in clinical practice. The purpose of this poster is to present the process of evaluation with manual calculation and with automated calculation.

Methods: When assessing bone age using the classical method with the atlas, a radiologist compares specific skeletal areas on the X-ray image with the corresponding areas on the most relevant reference images collected in the Greulich-Pyle atlas. In it. the images are separated by gender: for boys, the images range from 0-18 years, and for girls, from 0-19 years, at intervals of three months to one year. The BoneXpert program operates on machine learning, automatically analyzes and provides an assessment of bone age for boys aged 2.5-19 years and for girls aged 2-18 years. The final result is an X-ray image with calculated values that is saved as a DICOM file in the same folder of the hospital's PACS system as the original X-ray image.

Results: For the girl with normal skeletal morphology, we demonstrate the calculation with BoneXpert and describe the calculation with the atlas without values: the chronological age of the girl is 7.88 years, with values of 8.32 years according to Greulich-Pyle and 8.28 years according to Tanner-Whitehall system. A manual calculation is not necessary due to the normal skeleton.

Discussion and conclusion: BoneXpert shortens the time to diagnosis with a normal morphologic bone image. In a clinical setting, it is crucial for the radiologist to recognize situations where the analysis with BoneXpert is not useful and uses manual calculation. The human factor in determining bone age remains critical.

Keywords: paediatric, bone age, radiology, artificial intelligence - AI, BoneXpert

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PERKUTANO MINIMALNO INVAZIVNO ZDRAVLJENJE HERNIJE DISKA

PERCUTANEOUS MINIMALLY INVASIVE TREATMENT OF DISC HERNIATION

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IZVLEČEK

Uvod in namen: Število odraslih obremenjenih z akutno in kronično bolečino v hrbtenici je v svetu vse pogostejše. Ocenjuje se, da ima približno 80 % odraslih v zahodnem svetu bolečine v hrbtenici. Eden najpogostejših vzrokov za bolečine v hrbtenici je hernija diska, ki sproži bolečino preko mehanske kompresije z imunološkimi in vnetnimi spremembami.

Z leti se je pojavilo več različnih terapij za zdravljenje hernije diska, od konzervativnega zdravljenja, do minimalno invazivnega in perkutanega zdravljenja, vse do odprtih kirurških posegov.

Konzervativno zdravljenje je glavni steber zdravljenja za večino bolnikov, obstaja pa vse večja zaskrbljenost glede uporabe opioidne terapije. Poleg tega vztrajna bolečina (več kot 6 mesecev) pogosto vodi v razmislek o minimalno invazivnih tehnikah ali odprti operaciji. Odprta operacija je lahko učinkovita 49–95%, vendar prinaša tveganje splošne anestezije, visokih stroškov in pooperativnih zapletov.

Alternativa kirurški terapiji so številni minimalno invazivni postopki, uporaba katerih se je drastično povečala skozi leta. Namen teh postopkov je zmanjšanje pritiska na medvretenčno ploščico in razbremenitev hernije diska brez poškodbe hrbteničnega kanala.

Pogosto ponavljajoč se minimalno invaziven postopek je uporaba preparata DiscoGel (radiopačen želatinast etanol). DiscoGel je sterilna viskozna raztopina, ki vsebuje: etilni alkohol, celulozno derivatni produkt in volfram (radioneprepustni element).

96-odstotni čisti etilni alkohol povzroči lokalno nekrozo jedra medvretenčne ploščice, deluje mehansko prek dehidracije diska ter ima dvojni mehanizem delovanja na znotraj vretenčni disk:

- hidrofilno moč (ki vodi migracijo vode z obrobja/periferije diska do dekompresije diska in zmanjšuje znotrajdiskalni pritisk),
- sočasno odlaganje dela gela na mestu injiciranja.

Glavni pomanjkljivosti etanola pa sta prekomerna difuznost in pomanjkanje radiološke preglednosti.

Metode: Literatura, opis primera iz naše bolnišnice ter protokol slikanja, ki ga uporabljamo pri perkutanem minimalno invazivnem zdravljenju hernije diska.

Rezultati in razprava: Zaradi bolečin v križu (lumbago) s pridruženim išiasom, bolečinami v ledveni hrbtenici in desni spodnji okončini, šepanja pri hoji in močnega drevenenja v desno nogo, je bil pacient napoten na MR preiskavo ledvene hrbtenice (junij 2022). Na podlagi MR izvida in diagnoze je bil pacient predlagan za perkutano minimalno invazivno zdravljenje (januar 2023).

Pred začetkom posega inštrumentarka pripravi material ter pacienta namesti na preiskovalno mizo. Bolniki z bolečinami v ledvenem delu hrbtenice so nameščeni v bočni položaj. Noge so rahlo pokrčene. V tem položaju bolnik nato izboči hrbet (mačji hrbet). Inštrumentarka sterilno umije vbodno mesto in pacienta sterilno pokrije. Ker je poseg potekal v lokalni anesteziji, je na začetku posega zdravnik perkutano z leve strani pod kontrolo diaskopije v podkožje do nivoja levega fasetnega sklepa apliciral lokalni anestetik 1% Xylocain. Poseg je potekal brez zapletov. Po posegu je bilo odrejeno 2-urno mirovanje na oddelku. Pacient je bil nato odpuščen v domačo oskrbo. Dobil je pisna navodila za mirovanje in postopno obremenjevanje po posegu. V primeru poslabšanja naj bi kontaktiral operaterja, na kontrolni pregled pa je bil naročen čez 3 mesece.

Vloga radiološkega inženirja pri perkutanem minimalno invazivnem zdravljenju je natančno spremljati zdravnika in področje kjer izvaja poseg. Z diaskopijo moramo cev RTG aparata postaviti v položaj, pri katerem je hrbtenica pozicionirana povsem stransko, kar uravnavamo s kotoma RAO IN LAO. Prav tako moramo poravnati terminalne plošče obeh vretenc (zgornjo in spodnjo terminalno ploščo obeh vretenc v področju posega) s kotoma kranialno in kavdalno. Ves čas preiskave spremljamo zdravnika z diaskopijo na področju posega ter po njegovih navodilih premikamo cev iz položaja AP v stranski položaj in nazaj (večkrat). S tem omogočimo zdravniku, da spremlja pot igle s katero zbada ter vbrizgava DiscoGel.

Zaključek: S perkutanim minimalno invazivnim zdravljenjem zmanjšamo pritisk na disk in razbremenimo hernijo diska brez poškodb hrbteničnega kanala. Pogosto ponavljajoč se minimalno invaziven postopek je uporaba preparata DiscoGel. Obravnavali smo pacienta zaradi bolečin v križu (lumbago) s pridruženim išiasom, bolečinami v ledveni hrbtenici in desni spodnji okončini, šepanja pri hoji in močnega drevenenja v desno nogo. Opravili smo perkutano invazivno zdravljenje z aplikacijo DiscoGela.

Ključne besede: diskus hernija, perkutano minimalno invazivno zdravljenje, DiscoGel

ABSTRACT

Introduction and Purpose: The number of adults burdened by acute and chronic low back pain is increasing worldwide. It is estimated that approximately 80 % of adults in the Western world have back pain. One of the most common causes of back pain is a herniated disc, which triggers pain through mechanical compression with immunological and inflammatory changes.

Over the years, several different therapies have emerged for the treatment of herniated discs, ranging from conservative treatment to minimally invasive and percutaneous treatment, to open surgery.

Conservative treatment is the mainstay of treatment for most patients, but there is growing concern about the use of opioid therapy. In addition, persistent pain (more than 6 months) often leads to consideration of minimally invasive techniques or open surgery. Open surgery can be 49-95 % effective but carries the risk of general anaesthesia, high costs and post-operative complications.

Alternatives to surgery include several minimally invasive procedures, the use of which has increased dramatically over the years. The aim of these procedures is to reduce the pressure on the intervertebral disc and relieve the disc herniation without damaging the spinal canal.

A frequently repeated minimally invasive procedure is the use of DiscoGel (radio-opaque gelatinous ethanol). DiscoGel is a sterile viscous solution containing ethyl alcohol, a cellulose-derivative product and tungsten (a radio-opaque element).

The 96 % pure ethyl alcohol causes local necrosis of the nucleus of the intervertebral disc, acts mechanically through disc dehydration, and has a dual mechanism of action on the intra-vertebral disc:

- hydrophilic power (which guides the migration of water from the periphery of the disc to the decompression of the disc and reduces intradiscal pressure),
- simultaneous deposition of part of the gel at the injection site.

The main disadvantages of ethanol are excessive diffusivity and lack of radiological transparency.

Methods: Literature, a case report from our hospital and the imaging protocol used for percutaneous minimally invasive treatment of herniated disc.

Results and Discussion: Due to low back pain (lumbago) with associated sciatica, pain in the lumbar spine and right lower limb, claudication when walking, and severe right leg pain, the patient was referred for MRI of the lumbar spine (June 2022). Based on the MRI findings and diagnosis, the patient was proposed for percutaneous minimally invasive treatment (January 2023).

Before the procedure, the instrumentation nurse prepares the material and places the patient on the examining table. Patients with lumbar spine pain are placed in the lateral position. The legs are slightly flexed. In this position, the patient then arches his back (cat-back). The instrumentation nurse washes the puncture site sterilely and covers the patient sterilely. As the procedure was performed under local anaesthesia, at the start of the procedure the doctor injected the local anaesthetic 1 % Xylocaine percutaneously from the left side under diascopy control into the subcutaneous tissue to the level of the left facet joint. The procedure was uneventful. After the procedure, a 2-hour ward stay was ordered. The patient was then discharged to home care. They were given written instructions for bed rest and gradual weight bearing after the procedure. In case of deterioration, they were to contact the operator, and were scheduled for a follow-up examination in 3 months.

The role of the radiographer in percutaneous minimally invasive treatment is to closely monitor the doctor and the area where the procedure is being performed. The diascopy must be performed with the tube of the X-ray machine in a position where the spine is positioned fully lateral, which is controlled by the RAO AND LAO angles. The terminal plates of both vertebrae (the upper and lower terminal plates of both vertebrae in the area of the procedure) must also be aligned with the cranial and caudal angles. Throughout the examination, we accompany the physician with diascopy in the intervention area and move the tube from the AP position to the lateral position and back (several times) according to his instructions. This allows the physician to monitor the path of the needle used to prick and inject the DiscoGel.

Conclusion: Percutaneous minimally invasive treatment reduces pressure on the disc and relieves disc herniation without damage to the spinal canal. A frequently repeated minimally invasive procedure is the use of DiscoGel. We treated a patient for low back pain (lumbago) with associated sciatica, pain in the lumbar spine and right lower limb, claudication when walking and severe right leg stubbing. Percutaneous invasive treatment with DiscoGel was performed.

Keywords: disc herniation, percutaneous minimally invasive treatment, DiscoGel

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POLOŽAJ JEZIKA PRI PANORAMSKEM SLIKANJU ZOB

TONGUE POSITION IN PANORAMIC DENTAL IMAGING

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IZVLEČEK

Uvod in namen: Panoramsko slikanje zob z minimalnim odmerkom ionizirajočega sevanja zajame celotno ustno votlino na eni sliki. Pogosta napaka pri tej tehniki slikanja je napačen položaj jezika, kar se kaže kot temen pas na rentgenski sliki, ki prekrije korenine zob v zgornji čeljusti. Cilj raziskave je bil ugotoviti, ali ima plakat kot vizualni vir navodil vpliv na razumevanje pacientov ter s tem zmanjšuje napake pri položaju jezika.

Metode: Raziskavo smo izvedli z uporabo kvantitativne (eksperimentalne) raziskovalne metode. Po prvotnem pregledu 1500 slik v treh mesecih smo ustvarili tri različne plakate z navodili za pravilen položaj jezika pri panoramskem slikanju zob. Plakati so bili tri mesece izobešeni v čakalnici ZD Ljubljana, po 3 mesecih pa smo ponovno analizirali 1500 slik, ki so nastale v tem obdobju.

Rezultati: Rezultati kažejo, da je odstotek napačnega položaja jezika znašal 36,1 %, ko plakati niso bili nameščeni, in 36 %, ko so bili nameščeni, torej so razlike minimalne oziroma skoraj nične. Opazili smo izboljšanje pravilnosti položaja jezika, če smo šteli slike z zrakom, ki so bile sicer še vedno diagnostično uporabne, kot napačne. Število pravilnih položajev se je povečalo s 34,1 % na 42 %. Glede na spol so imele ženske tako brez plakata kot z njim nekoliko boljše rezultate pri ustreznem položaju jezika med slikanjem. Pri otrocih, slikanih brez plakata, smo ugotovili največ napačnih položajev jezika (66 %), vendar smo pri njih ob namestitvi plakatov opazili tudi znatno izboljšanje v pravilnosti položaja jezika.

Razprava in zaključek: Raziskava je pokazala, da namestitev plakatov ni bistveno vplivala na izboljšanje pravilnosti položaja jezika pri panoramskem slikanju zob, saj je bil odstotek pravilnega položaja jezika pred in po plakatu skoraj enak. Spol ni ključni dejavnik pri vplivu na pravilnost položaja jezika, medtem ko so se pojavile nekatere razlike v izboljšanju pravilnosti glede na starostno skupino.

Ključne besede: panoramsko slikanje zob, položaj jezika, plakati z navodili, napake pri slikanju zob, zobni rentgen

ABSTRACT

Introduction and purpose: In dental panoramic imaging the entire oral cavity is captured in a single image with a minimal dose of ionizing radiation. A common error in this imaging technique is the incorrect position of the tongue, which is visible as a dark band on the radiograph and obscures the roots of the teeth in the maxilla. The aim of the study was to determine whether a poster, which serves as a visual teaching aid, influences the patient's understanding and thus reduces errors in tongue positioning.

Methods: The study was conducted using a quantitative (experimental) research method. In the first part of the study, 1500 images were analyzed over a three-month period to determine the number of cases with errors due to incorrect tongue positioning. Three different posters were then created as a visual guide to correct tongue position in dental panoramic imaging. These posters were hung in the waiting room of the Community Health Centre Ljubljana for three months, and then another 1500 images were analyzed over the following three months.

Results: The results show that the percentage of incorrect tongue positions was 36.1% when no posters were hung and 36% when they were hung, indicating minimal or almost negligible differences. An improvement in tongue position accuracy was observed when images with air, but which were still diagnostic, were categorized as incorrect. The number of correct tongue positions increased from 34.1% to 42%. In terms of gender, females achieved slightly better results in tongue position accuracy both with and without posters. The highest percentage of incorrect tongue positions was observed in children without the poster (66 %), but a significant improvement in tongue position accuracy was observed after the poster was attached.

Discussion and conclusion: The study found that poster placement had no significant effect on the improvement of tongue position accuracy in dental panoramic images, as the percentage of correct tongue positions before and after poster placement was almost identical. Gender was not a significant factor affecting tongue position accuracy, although some differences in improvement were noted between age groups.

Keywords: panoramic dental imaging, tongue position, instructional posters, dental imaging errors, dental radiography

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Zmanjšanje nelagodja za bolnike in lažji potek preiskave za zdravnike[1-4]

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SESTAVA ZDRAVILA: 1 ml vsebuje 550 mg jodiksanola, kar ustreza 270 mg joda/ml ali 652 mg jodiksanola, kar ustreza 320 mg joda/ml. **INDIKACIJE:** Rentgensko kontrastno sredstvo za kardioangiografijo, cerebralno angiografijo (konvencionalno in i.a. DSA), periferno arteriografijo (konvencionalno in i.a. DSA), abdominalno angiografijo (i.a. DSA), urografijo, venografijo, CT - ojačanje. Lumbalna, torakalna in cervikalna mielografija. Samo za diagnostične namene. **ODMERJANJE IN NAČIN UPORABE:** Odmerjanje je različno glede na tip preiskave, starost, telesno maso, delovanje srca in splošno stanje bolnika ter uporabljeno tehniko. Zdravilo je namenjeno za intravensko, intra-arterijsko in intratekalno uporabo. Odmerki, ki lahko služijo kot vodilo, so navedeni v Povzetku glavnih značilnosti zdravila. **KONTRAINDIKACIJE:** Preobčutljivost na učinkovino ali katero koli pomožno snov. Manifestni hipertiroidizem. Resne preobčutljivostne reakcije na Visipaque v anamnezi. **POSEBNA OPOZORILA IN PREVIDNOSTNI UKREPI:** Pri bolnikih s pozitivno anamnezo za alergijo, astmo ali neželene reakcije na jodirana kontrastna sredstva je potrebna posebna previdnost. Vedno je treba upoštevati možnost pojava preobčutljivosti, vključno z resnimi, življenje ogrožajočimi, smrtnimi anafilaktičnimi/anafilaktoidnimi reakcijami. Bolniki, ki uporabljajo antagoniste adrenergičnih receptorjev β, imajo lahko atipične simptome preobčutljivosti, ki jih je možno napačno interpretirati kot vagalno reakcijo. Med angiokardiografskimi postopki z ionskimi in neionskimi kontrastnimi sredstvi so poročali o resnih, redko smrtnih tromboemboličnih dogodkih, ki so povzročili miokardni infarkt in kap. Priporoča se uporaba izjemno natančnih angiografskih tehnik, pri katerih je posebna pozornost namenjena ravnanju z nastavki in katetri, uporabi podaljškov z več cevmi in/ali t.i. tripotnih petelinčkov, pogostemu spiranju katetrov s heparinoziranimi fiziološkimi raztopinami in skrajšanju trajanja postopka. Napredno opremljene enote za oživljanje in vzdrževanje življenjskih funkcij morajo biti na razpolago. Previdnost je potrebna pri bolnikih s homocistinurijo (tveganje za tromboembolizem). Pred dajanjem kontrastnega sredstva in po njem je treba zagotoviti ustrezno hidracijo. To velja zlasti za bolnike, ki imajo multipli mielom, sladkorno bolezen, disfunkcijo ledvic, kakor tudi za dojenčke, majhne otroke in starejše bolnike. Previdnost je potrebna pri bolnikih z resno boleznijo srca in pljučno hipertenzijo, pri bolnikih z akutno cerebralno patologijo, tumorji ali epilepsijo v anamnezi, pri alkoholikih in odvisnikih od mamil. Glede intravaskularnega dajanja je potrebna previdnost pri bolnikih s kapjo v akutni fazi ali akutno intrakranialno krvavitvijo, pri bolnikih s poškodbo krvno-možganske pregrade, cerebralnim edemom ali akutno demielinizacijo. Za preprečevanje akutne ledvične odpovedi po dajanju kontrastnega sredstva, je potrebna posebna pozornost pri bolnikih s predobstoječo disfunkcijo ledvic in sladkorno boleznijo, saj so ti bolniki ogroženi. Ogroženi so tudi bolniki s paraproteinemijo (mielomatoza in Waldenstromova makroglobulinemija). Jodirana kontrastna sredstva lahko prejmejo hemodializni bolniki. Pri bolnikih s sladkorno boleznijo, ki se zdravijo z metforminom, je pred intravaskularnim dajanjem jodiranega kontrastnega sredstva treba določiti serumsko raven kreatinina. Bolnik mora prenehati jemati metformin ob prejemu kontrastnega sredstva in ga ne sme ponovno začeti jemati najmanj 48 ur ali vse dokler serumska raven kreatinina/delovanje ledvic ni normalno. V kolikor je določena nenormalna serumska raven kreatinina/nenormalno delovanje ledvic mora bolnik prenehati jemati metformin in preiskava se odloži za 48 ur. Bolnik lahko začne ponovno jemati metformin samo, če je delovanje ledvic/serumska raven kreatinina nespremenjena. Posebna previdnost je potrebna pri bolnikih, ki imajo hude motnje delovanja ledvic ali jeter. Dajanje jodiranih kontrastnih sredstev lahko poslabša simptome miastenije gravis. Bolnikom s feokromocitomom, ki so podvrženi intervencijskim postopkom, je treba preventivno dati antagoniste α-receptorjev. Bolnike, pri katerih obstaja tveganje za tirotoksikozo, je treba skrbno oceniti pred uporabo jodiranega kontrastnega sredstva. Posebna pozornost je potrebna pri bolnikih s hipertiroidizmom. Pri bolnikih z nodozno golšo obstaja tveganje za razvoj hipertiroidizma po injekciji jodiranega kontrastnega sredstva. Treba se je zavedati možnosti sprožitve prehodnega hipotiroidizma pri nedonošenčkih, ki dobijo kontrastna sredstva. Po dajanju jodiranega kontrastnega sredstva nosečnici, je treba delovanje ščitnice pri novorojenčkih preveriti v prvem tednu življenja. Vnovičen pregled delovanja ščitnice je priporočljiv v 2.-6. tednu starosti, zlasti pri tistih z majhno telesno maso pri rojstvu ali nedonošenčkih. V primeru ekstravazacije se kot rutinski ukrep priporoča privzdignjenje in hlajenje prizadetega mesta. V primerih ''compartment'' sindroma je lahko potrebna kirurška dekompresija. Po dajanju kontrastnega sredstva je treba bolnika opazovati vsaj 30 minut. Preobčutljivostne reakcije se lahko pojavijo tudi še nekaj ur ali celo dni po injekciji. Po mielografiji mora bolnik 1 uro počivati v položaju s privzdignjeno glavo in dvignjenim prsnim košem za 20°. Po tem se lahko previdno premakne, vendar se mora izogniti sklanjanju. Glava in prsni koš morata biti privzdignjena prvih 6 ur, če ostane v postelji. Bolnike, za katere se sumi, da imajo nizek prag za napade, je v tem obdobju treba opazovati. Bolniki na domu prvih 24 ur ne bi smeli biti popolnoma sami. Visipaque vsebuje 0,45 mg (0,02 mmol) natrija na 1 ml raztopine. Kontrastnega sredstva se v nosečnosti ne sme uporabljati, razen če je korist večja od tveganja in zdravnik presodi, da je preiskava nujno potrebna. Doječe matere lahko po prejemu jodiranega rentgenskega kontrastnega sredstva nemoteno nadaljujejo z dojenjem. V prvih 24 urah po intratekalni preiskavi ni priporočljivo voziti avta ali upravljati strojev. **INTERAKCIJE:** Jodirana kontrastna sredstva lahko vplivajo na teste delovanja ščitnice, tako da je lahko sposobnost ščitnice za vezavo joda zmanjšana za več tednov. Velike koncentracije kontrastnih sredstev v serumu in urinu lahko vplivajo na laboratorijske preiskave za bilirubin, proteine ali anorganske snovi (npr. železo, baker, kalcij in fosfat). Zato se teh snovi ne sme določati na dan preiskave. Uporaba jodiranih kontrastnih sredstev lahko povzroči prehodno oslabitev ledvičnega delovanja, to pa lahko izzove laktatno acidozo pri sladkornih bolnikih, ki jemljejo metformin. Pri bolnikih, ki so se manj kot 2 tedna pred injekcijo ionskega kontrastnega sredstva zdravili z interlevkinom-2, obstaja večje tveganje zapoznelih reakcij (gripi podobni simptomi ali kožne reakcije). Pri zdravljenju z antagonisti adrenergičnih receptorjev β so opazili hudo hipotenzijo ob uporabi rentgenskih kontrastnih sredstev. **NEŽELENI UČINKI:** Običajno so blagi do zmerni in prehodne narave. V zelo redkih primerih so opazili hude reakcije in smrtne primere, ki lahko vključujejo akutno poslabšanje kronične odpovedi ledvic, akutno odpoved ledvic, anafilaktični/anafilaktoidni šok, preobčutljivostne reakcije, ki jim sledijo reakcije srca (Kounisov sindrom), zastoj srca ali kardiorespiratorni zastoj in miokardni infarkt. Reakcije srca lahko sprožijo že obstoječe bolezni ali postopek preiskave. Preobčutljivostne reakcije se lahko izrazijo kot respiratorni ali kožni simptomi, kot so dispneja, izpuščaj, eritem, urtikarija, pruritus, hude kožne reakcije, angioedem, hipotenzija, povišana telesna temperatura, edem grla, bronhospazem ali pljučni edem. Pri bolnikih z avtoimunskimi boleznimi so bili opaženi primeri vaskulitisa in Stevens-Johnsonovemu sindromu podobnega sindroma. Pojavijo se lahko takoj po injiciranju ali do nekaj dni kasneje. Preobčutljivostne reakcije se lahko pojavijo ne glede na odmerek in način dajanja, blagi simptomi pa lahko predstavljajo prve znake hude anafilaktoidne reakcije/šoka. Dajanje kontrastnega sredstva je potrebno takoj prekiniti in, če je potrebno, vaskularno vpeljati specifično terapijo. **Intravaskularna uporaba:** Zelo pogosti (≥1/10): občutek toplote (pri periferni angiografiji). Pogosti (≥1/100 do <1/10): distalna bolečina (pri periferni angiografiji). Občasni (≥1/1,000 do <1/100): preobčutljivost, glavobol, vročinski oblivi/zardevanje, navzea, bruhanje, izpuščaj, pruritus, urtikarija, splošen občutek toplote, bolečina v prsih. Redki (≥1/10,000 do <1/1,000): omotica, aritmija (vključno z bradikardijo, tahikardijo), hipotenzija, kašelj, bolečina, nelagodje, tresenje (mrazenje), pireksija, reakcije na mestu aplikacije, vključno z ekstravazacijo. Zelo redki (<1/10,000): agitacija, anksioznost, cerebrovaskularni insult, senzorične motnje vključno z motnjami okušanja, parestezija, sinkopa, prehod kontrastnega sredstva v krvno-možgansko bariero, ki je včasih povezano s prehodno zmedenostjo ali kortikalno slepoto, prehodna kortikalna slepota, okvara vida, vagalne reakcije, hipertenzija, ishemija, dispneja, bolečina/neprijeten občutek v trebuhu, angioedem, eritem, bolečina v hrbtu, mišični krči, okvarjeno delovanje ledvic vključno z akutno odpovedjo ledvic, občutek mraza, astenična stanja (npr. splošno slabo počutje, utrujenost). **Intratekalna uporaba:** Lahko so zakasneli in se pojavijo nekaj ur/dni po postopku. Pogostnost je podobna kot pri sami lumbalni punkturi. Pri drugih neionskih kontrastnih sredstvih so opazili draženje možganskih ovojnic, ki povzroča fotofobijo in meningizem ter neposreden kemični meningitis. Upoštevati je treba tudi možnost infekcijskega meningitisa. Podobno so v zelo redkih primerih pri drugih neionskih jodiranih kontrastnih sredstvih opazili pojav prehodne motnje delovanja možganov. Ta se kaže kot napadi, prehodna zmedenost ali prehodna motorična ali senzorična disfunkcija. Pri majhnem številu teh bolnikov so bile opažene spremembe v EEG. Občasni (≥1/1,000 do <1/100): glavobol (lahko hud in dolgotrajen), bruhanje. **Artrografija:** Občasni (≥1/1,000 do <1/100): bolečina na mestu injiciranja. Neželeni učinki neznane pogostnosti so navedeni v SmPC.

Poročanje o domnevnih neželenih učinkih: Poročanje o domnevnih neželenih učinkih zdravila po izdaji dovoljenja za promet je pomembno. Omogoča namreč stalno spremljanje razmerja med koristmi in tveganji zdravila. Od zdravstvenih delavcev se zahteva, da poročajo o katerem koli domnevnem neželenem učinku zdravila na Javna agencija Republike Slovenije za zdravila in medicinske pripomočke, Sektor za farmakovigilanco, Nacionalni center za farmakovigilanco, Slovenčeva ulica 22, SI-1000 Ljubljana, Tel: +386 (0)8 2000 500, Faks: +386 (0)8 2000 510, e-pošta: h-farmakovigilanca@jazmp.si, spletna stran: www.jazmp.si.

IMETNIK DOVOLJENJA ZA PROMET Z ZDRAVILOM: GE Healthcare AS, P.O. Box 4220 Nydalen, NO-0401 Oslo, Norveška **VELIKOST PAKIRANJA:** Visipaque 270 mg I/ml raztopina za injiciranje: 10 polipropilenskih vsebnikov po 100 ml. Visipaque 320 mg I/ml raztopina za injiciranje: 10 polipropilenskih vsebnikov po 100 ml ali 200 ml. 6 polipropilenskih vsebnikov po 500 ml. **NAČIN IN REŽIM IZDAJE:** ZZ. **DATUM PRIPRAVE INFORMACIJ:** november 2023.

Reference: 1. McCullough PA, Capasso P. BMC Med Imaging 2011; 11: 12. **2.** AHA/ACC. Circulation 2017; 135(12): e686-e725. **3.** ACR Manual on Contrast Media. 2020. **4.** Palena LM et al. Catheter Cardiovasc Interv 2014; 84(6): 1019–25.

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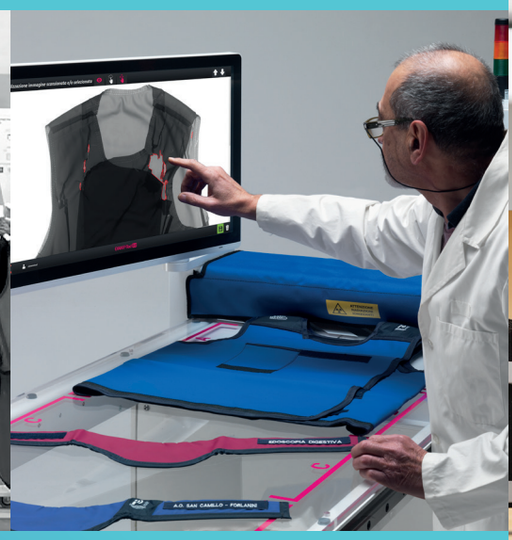

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