Prošireni sažetak / Extended abstract

Intrakoronarno snimanje
Intracoronary imaging

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Danas je u laboratoriju za kateterizaciju dostupan cijeli niz modaliteta oslikavanja. Uz standardnu koronarnu angiografiju, modaliteti intrakoronarnog snimanja, kao što su intravaskularni ultrazvuk (IVUS)[1] i optička koherentna tomografija (OCT)[2] se često koriste kako bi se procijenile nove opcije terapijskog liječenja te za vođenje intervencijskih postupaka. Trenutno je IVUS još uvijek referentna metoda za proučavanje in-vivo intervencijskih strategija[3]. Novi dizajni stentova mogu se procijeniti vizualizacijom apozicije žičice stenta, NIH rastom, remodeliranjem plaka[4] te također i promjenama komponente tkiva plaka tijekom vremena[5]. Međutim, od nedavno postoji sve više interesa da se novi modaliteti snimanja kao što su OCT i neinvazivna višeslojna kompjuterizirana tomografija — koronarna angiografija (MSCT-CA) koriste kao dodatni alati za snimanje uz IVUS. OCT kao prednost ima superiornu rezoluciju snimanja u usporedbi s IVUS, a dostupne neinvazivne metode snimanja kao što je MSCT bi kod longitudinalnih studija mogle biti preferirane od strane pacijenata te bi također mogle poboljšati istraživačko znanje pošto ne samo da pokazuju protočnost stentiranog područja već također i plak i njegov sastav.

Često se smatra da su ovi modaliteti konkurentni, međutim, više su komplementarni nego što su konkurentni. Usporedba ovih modaliteta međusobno je izazovan je zadatak zbog činjenice da imaju veoma različita fizikalna svojstva[6]. Stoga je kombiniranje ovih modaliteta snimanja vrlo dovitljiva opcija za korištenje tijekom prvih ispitivanja na ljudima te također moguće tijekom prve faze multicentričnih studija koje procjenjuju učinkovitost novih terapijskih strategija.

Kod studija koronarnih stentova, velika prednost OCT predstavlja izvrsna vizualizacija žičice stenta i njezine apozicije u trenutku implantacije te vizualizacija endotelijalizacije žičice strenta tijekom praćenja. U novoj generaciji bioabsorbilnih stentova načinjenih od poli-l-laktične kiseline (PLLA) može se kvantificirati čak i širina i debljina žičice stenta[7]. Čini se da su trenutni nedostaci kao što su zatvaranje žile i niska dubina penetracije riješeni u nadolazećim generacijama OCT dizajniranih katetera koji se nazivaju OFDI.

MSCT-CA brzo postaje popularna metoda koja se koristi kao dodatni alat za dijagnostičko snimanje. Naravno, njezina neinvazivna priroda bi ju mogla učiniti izvrsnim alatom za primjenu u longitudinalnim studijama. Dostupan je kvantifikacijski softver te se dimenzije lumena i krvne žile mogu kvantificirati. Međutim, njegova rezolucija slike u usporedbi s IVUS je mnogo niža (120?m prostorno i 80?m plošno za IVUS nasuprot 400?m prostorno i plošno za MSCT od 64 sloja). Nadalje, i kalcificirane i metalne strukture uzrokuju "blooming" učinak (blještavost) na CT slikama, što može ograničiti točnost kvantifikacije. Novije generacije skenera bi

Today a large array of imaging modalities is available in the catheterization laboratory. Besides standard coronary angiography, intracoronary imaging modalities, such as intravascular ultrasound (IVUS)[1] and optical coherence tomography (OCT)[2] are often used to evaluate new therapeutic treatment options and to guide interventional procedures. Currently, IVUS is still the reference method to study in-vivo new interventional strategies[3]. New stent designs can be evaluated by visualizing stent strut apposition, NIH growth, plaque remodeling[4] and possibly also plaque tissue component changes over time[5]. However, recently, new imaging modalities such as OCT and the non-invasive multi-slice computed tomography coronary angiography (MSCT-CA) are gaining rapidly large interest to be used as additional imaging tools besides IVUS. OCT has as advantage a superior image resolution over IVUS and of course the availability of a non-invasive imaging method as MSCT for longitudinal studies could be preferred by the patients and also it could improve research knowledge since it not only shows the patency of the stented area but also the plaque and its composition.

Often it is thought that these modalities are competitors, however, they are more complementary as they are competitive. A 1-to-1 comparison of these modalities is a challenging task due to the fact that they have very different physical properties[6]. Therefore, combining these imaging modalities is a very resourceful option to be used during first-in-man studies, and possibly also during the first phase of multi-center trials, evaluating the effectiveness of new therapeutic strategies.

In coronary stent studies, the big advantage of OCT is the excellent visualization of the stent struts and its apposition at the time of implantation and to visualize the endotheliazation of the struts at follow-up. In the new generation of bio-absorbable stents made of poly-l-lactic-acid (PLLA) even the width and thickness of the struts can be quantified[7]. The current disadvantages such as closure of the vessel and low penetration depth, seems to be solved in the upcoming generation of OCT catheter designs called OFDI.

MSCT-CA is becoming rapidly popular to be used as an additional diagnostic imaging tool. Of course, its non-invasive nature could make it an excellent tool to be applied in longitudinal studies. Quantification software is available and lumen- and vessel-dimensions can be quantified. However, its image resolution as compared to IVUS is much lower (120?m spatial and 80?m in-plane for IVUS vs. 400?m spatial and in-plane for 64-slice MSCT). Furthermore, both calcium and metallic structures are causing a blooming effect on CT images, which could hamper accurate quantification.

potencijalno mogle riješiti ove ograničavajuće čimbenike. Međutim, čini se da se u slučaju novog PLLA bioabsorbilnog stenta MSCT može koristiti za kvantifikaciju lumena i krvnih žila8. Moguće je da bi se MSCT također mogao koristiti za detektiranje i kvantifikaciju promjena u sastavu plaka[9]; međutim, potrebna su daljnja istraživanja.

Kako bi iz ova 3 modaliteta snimanja dobili optimalne podatke, ključni čimbenik je pronalaženje točnog područja interesa za svaki pojedini modalitet. Danas se ovo i dalje mora razvijati interno, međutim, pod uvjetom da imamo mogućnost usporedbe IVUS, OCT i MSCT snimaka postavljenih jedna pored druge i sinkronizirano na jednom računalnom ekranu9. Ovo je najoptimalnija situacija za ispitivanje mehaničkih i bioloških učinaka novih dizajna stentova kako bi se riješili problemi koji se pojavljuju kod koronarne bolesti srca10.

Ključne riječi: koronarna angiografija, intravaskularni ultrazvuk, koronarna angiografija višeslojnom kompjutoriziranom tomografijom.

Newer generation scanners could potentially solve these limiting factors. However, in case of the new PLLA bioabsorbable stent, it seems that MSCT can be used for lumen and vessel quantification8. Possibly, MSCT could also be used to detect and quantify plaque compositional changes[9]; however, further research is still required.

To derive the optimal information out of these 3 imaging modalities, the key-factor is to find the exact region of interest for every individual modality. Today, this must be still developed in-house, however, providing the ability to compare IVUS, OCT and MSCT onto one single computer screen on top of each other and synchronized9. This is the most optimal situation to study the mechanical and biological effects of new stent designs to resolve problems occurred in coronary artery disease[10].

Keywords: coronary angiography, intravascular ultrasound, multi-slice computed tomography coronary angiography.

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