

# Webbase Online Consulting System for Quasi Real Time Consultations of Cardiac Images

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## Abstract

*The authors have constructed a web base consulting program (Online Consulting System: OCS) for cardiac images especially for coronary angiograms. The DICOM movies from the PACS server of the catheterization laboratory are uploaded by secured 128 bit Virtual Private Network (VPN) connection without compression by a “send to DICOM node” command to a mini PACS hosting the OCS. After then the php modul checked the AETITLE + IP source, the communication is taking place on the TCP/IP 104 port. The uploads of the images of one patients takes 1-15 minutes depending on the bandwidth and the size of the DICOM files. After the upload, the movies can be downloaded by a real-time-like speed from any Internet connected place. The secured connection is performed by SSL protocol (https) which identifies the “receiver”. The viewer is based html5, therefore it runs in any browser program without the need for further application; however it is also possible to download the original DICOM files for further evaluations. Tablets and mobiles with the usual platforms can also be used for the consultations, the latter has the advantage in urgent cases, because sending an SMS or E-mail containing the link of the uploaded urgent coronary angiography enables the consultant invasive cardiologist to see immediately the movies on his/her smartphone or tablet or PC. The OCS can integrate the consultations of cardiac imaging modalities (echocardiography, CT, MR, IVUS, OCT) in DICOM forms. Using the OCS also for ECG trace transmission, the system is also useful for prehospital consultations during the treatment of acute coronary syndrome.*

## 1. Introduction

Diagnostic quality cardiology images especially the coronary angiogram movies in DICOM (Digital Imaging and Communications in Medicine) format represents

relatively large files in the range of 100-500 Mbytes [1].

Teleconsultations of these files can be performed from a Picture Archiving and Communication System (PACS) through the Internet. However this process in common bandwidth circumstances usually associates with significant time delay despite appropriate compression techniques. Reading the transmitted DICOM files on the “receiver site” can be achieved by a DICOM viewer. Other application (not readily available on every computer/laptop/tablet/smartphone) can be required for the viewer function if the DICOM files had been transformed to such a movie files like avi or mpeg before or after the transmission. Transformation of the DICOM files affords more compression with less time requirement of the file transfer and reading at the expense of the decreased resolution and quality of the images.

For the transfer of the patients’ documentation the security of data is also an issue [2,3].

Our aim was to develop such a web base consulting program that can send the DICOM data from the PACS server of the catheterization laboratory by secured connection to a central server from where the converted movies can be streamed by a very fast client/server response from any Internet connected place without the need for further application.

## 2. Methods

A web base consulting program (Online Consulting System: OCS) for cardiac images especially for coronary angiograms was constructed (<http://ocs.debkard.hu>). The DICOM movies from the PACS server of the catheterization laboratories are uploaded by secured 128 bit Virtual Private Network (VPN) connection without compression by a “send to DICOM node” command to a mini PACS hosting the OCS. After then the php (Hypertext Preprocessor) module checks the AETITLE (Application Entity Title) + IP (Internet Protocol) source, the communication is taking place on the TCP (Transmission Control Protocol) / IP 104 port (Figure 1.).



Figure 1. The communicates via Internet by VPN connections among the DICOM servers of the catheterization laboratories.

The uploads of the images of one patients takes 1-15 minutes depending on the bandwidth and the size of the DICOM files. After the upload, the movies can be streamed by a real-time-like speed from any Internet connected place. The secured connection is performed by SSL protocol (https) which restricts the access only for the authorized users. The viewer is based html (Hypertext Markup Language)<sup>5</sup>, therefore it runs in any browser program without the need for further plugin or application. On the same time it is also possible to download the original DICOM files for further evaluations.

### 3. Results

#### 3.1. Ready to view platforms of the OCS

The OCS can be used for the consultations with personal computers, mobile computing devices such as laptop, personal digital assistants (PDA), tablets and smartphones with the usual platforms, the latter has the advantage in urgent cases, because sending an SMS or E-mail containing the link of the uploaded urgent coronary angiography enables the consultant invasive cardiologist the most immediate way to see the movies on his/her device.

#### 3.2. Quality of the images

The uploads of the images is performed for every imaging modality in the original DICOM format. On the OCS server the images will be transformed to a Flash (flv) format without compression. The resulting images will be in the same resolution (usually in 512x512 pixels) than in the source files.

If higher resolution is used during the investigation

than the OCS also can transform the images even to a near full HD quality. Figure 2 shows an image of a coronary angiography in the OCS and in a web based viewer.

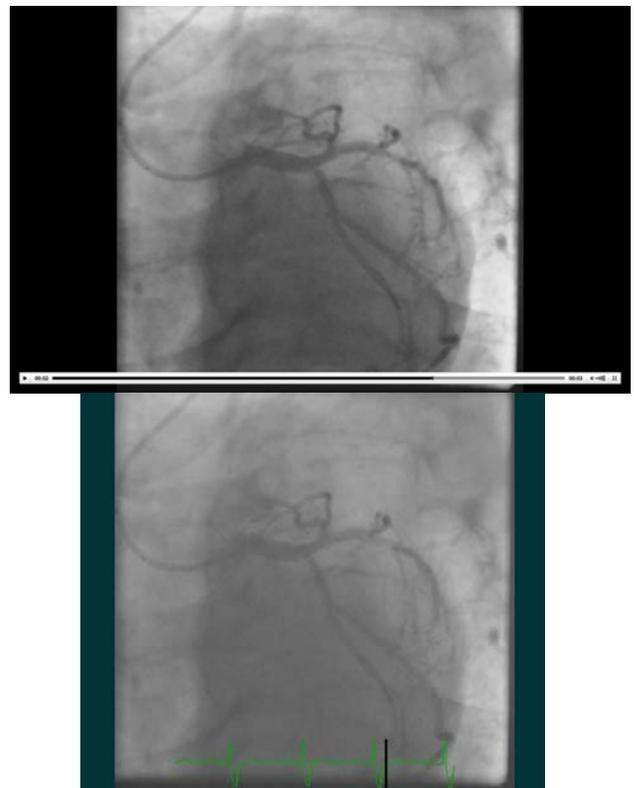


Figure 2. The same image from the OCS with the menu of the program (above), in full screen mode (middle) and from a web based viewer (JAVA application) of an X-ray equipment vendor (under)



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