

# Digital Radiographic Complexes for Traumatological Department

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**Abstract** — The paper deals with a budget digital X-ray equipment in operating trauma unit. The proposed set of equipment lets receive X-ray images of required quality at a significantly reduced requirements for radiation protection in the operating room, and to protect the personnel. We consider two variants of the equipment: for operating rooms in the traumatological department in the central district hospitals on the basis of portable X-ray unit and pediatric trauma unit on the basis of micro focus X-ray generator.

**Index Terms** — *casualty departments, high-frequency X-ray monoblock, microfocus X-ray unit, digital detector, minimal price, radiation safety*

## I. PURPOSE

Radiological imaging plays a critical role in patients with trauma. On the one hand, it allows to diagnose traumatic injuries, on the other hand, to control the quality of surgical operations. Currently, expensive X-ray equipment with C-arc is widely used, but it is a significant radiation exposure to patients and staff. The aim of the work is to develop and implement to the clinical practice the budget options of digital X-ray equipment for rapid diagnostics and monitoring performance in quasi-real time the results of surgical interventions in casualty departments with minimal radiation exposure to patients and staff.

## II. MATERIALS AND METHODS

The kits consisting of: high-frequency X-ray monoblock SY-HF-110 (output power 2.2 kW) with a mobile stand, digital detector "Iona-R4000" with stand S-30TS and adapter to the surgical table for operating (Fig.1) and microfocus X-ray unit type "Pardus", a special tripod and digital detector "Iona-R2430" for pediatric & wrist trauma departments were offered (Fig. 2).



Fig.1 Digital X-ray complex in the operating room of casualty department



Fig.2 Microfocus digital X-ray complex

Both complexes can carry out examinations in direct and lateral views. Microfocus X-ray generator allows to perform X-ray images in zoom mode, and thereby enhance its detail.

### III. RESULTS

Digital images, obtained using this equipment, provides the necessary diagnostic information trauma surgeon. Producing an image on the screen is less than 15 seconds, which allows surgeons to control the accuracy of operations & to do control images in near-real-time. Typically, an X-ray image is performed in the beginning of the operation and after it is completed (Figure 3). At the osteosynthesis it could be necessary to get a few more images for the control precision of manipulation. Using the zoom mode at the digital microfocus X-ray helps to determine pathology, which is not visible on standard X-ray images.



Fig. 3 Control of the results of the operation

For an example, the panoramic image and finger image in zoom mode, which allowed to make the diagnosis of rheumatoid arthritis (Fig. 4).



Fig.4. Rheumatoid arthritis: surface erosion not visible on traditional plain X-ray images

Because during the year, in central district hospital fewer than a thousand operations usually are performed requiring X-ray inspection, the total number of X-ray images for the year will not exceed 3000. This means that even if the exposure time of 1 s., time of X-ray system being a source of ionizing radiation does not exceed one hour per year. Considering that the radiation leakage in accordance with the regulations must not exceed 1.0 mSv / h at a distance of 1.0 m, we can say that when the personnel follows the requirements of radiation safety, referred in the operating instructions, using such systems will not be dangerous to the patient or the staff of X-ray room.

The proposed digital systems allow for a minimal price to provide total radiation safety for staff and patients. If necessary, a digital image can be written to disk and given to the patient or sent for consultation in X-ray department, where it can be viewed on the radiologist's workstation.

### IV. CONCLUSION

The proposed equipment systems for digital radiography promptly provide the necessary information for trauma surgeons and can therefore be recommended as a budget option for use in casualty departments, including the operating room.