

Evaluation Of The Diagnostic Potential Of A Novel Tomosynthesis System For MSK

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Purpose

Digital tomosynthesis (DTS) is a well-established technology that has become the gold standard for breast mammography. In recent years its benefits in musculoskeletal (MSK) imaging have been acknowledged and lead to a rapid increase in its utilization. It improves the detection, localization and characterization of subtle fractures, erosions and other bone lesions and can exclude false lesions related to complex bony anatomy. In some patients DTS can alleviate the need for CT with a fraction of the radiation dose and number of images per study. Recently a new technology based on Cold Cathode X-ray tube with a multi tube set-up has made this technology more affordable and hence more accessible. The purpose of this study is to evaluate the diagnostic potential of the cold-cathode multi-tube DTS.

Shamir medical center is one of the largest government hospitals in Israel, and is affiliated with Tel Aviv University.

Methods and Materials

The study population included 19 patients with known fractures that underwent CT and radiographs (XR) as part of the clinical work-up. After receiving informed consent, patients were scanned using the cold-cathode DTS within a timeframe of up to 10 days from the XR. 9 patients had imaging performed with Cast, 3 had metal stabilizer, 3 had metallic implants. Images were evaluated by an MSK radiologist and orthopaedic surgeon in consensus. The orthopaedic surgeon had no experience in DTS. The XR was evaluated first, followed by the DTS. Then, CT served as the gold standard.

Studies were evaluated for presence, anatomic location, intraarticular involvement of the fracture, displaced fragments, additional fractures and incidental lesions. The orthopaedic surgeon was asked whether the DTS provided valuable information and if it increased the confidence of the final diagnosis.

Results

In 17/19 studies DTS added value to the XR. In 7/19 DTS found at least one XR occult fracture (femoral neck, Tibial Plateau, Odontoid process, Anterior tibiofibular ligament, MTT, Tong, Malleolus). In 3 studies DTS was able to clear a suspected fracture (capitate, inner acetabular plate, malleolus), in 5 studies DTS was able to better localize the detected fracture. In 1 study DTS was able to determine fracture age and in 1 study DTS found sclerotic lesion obscured in DTS. In addition, on XR the cast limited evaluation of fine bony details, however there was no such limitation with DTS.

Prof. Sigal Tal, head of radiology in Shamir medical center said: "The Nanox.ARC has been implemented in our hospital for several months now and has proven itself as an effective tool in our clinical workflow, enabling us to receive quicker diagnosis using the Nanox.ARC as a supplemental tool to the X-ray system than scheduling the patient to a dedicated CT".

Dr. Iftah Beer, head of the orthopedics department in Shamir has reviewed all studies performed in Shamir and mentioned "in all relevant studies the Nanox.ARC system provided additional information to the standard X-ray, information which we later on corroborated using the CT exams of the same patients. All Nanox.ARC images were of high diagnostic quality enabling optimal depiction of findings".

Conclusion

This study demonstrates Cold cathode DTS provides high quality tomography of various anatomies which can increase depiction of occult pathologies, localize, characterize and resolve questionable findings.

Clinical Relevance/Application:

The study affirms Cold cathode DTS is an affordable and accessible technology that can potentially improve the clinical workflow by providing additional information compared to XR and add confidence in MSK diagnosis. When performing cast imaging DTS can improve the diagnosis. Further studies are required to determine applicability for reducing the need for CT. DTS can further assist in the presence of metal due to inherent limitations of CT imaging.



On XRAY - The cast obscures fine bony details. There is a suspected subluxation of the 2nd MTP



On DTS, we can see Avulsion fracture of the Lisfranc ligament (left) , Intraarticular fracture of the 2nd MTT (middle) as well as an additional displaced bony fragment (orange) and a 4th MTT fx (right)