The use of needle guidance software within interventional radiology

DOBSON, Stephanie and HARCUS, James

Available from Sheffield Hallam University Research Archive (SHURA) at:
http://shura.shu.ac.uk/12694/

This document is the author deposited version. You are advised to consult the publisher's version if you wish to cite from it.

Published version


Copyright and re-use policy

See http://shura.shu.ac.uk/information.html
Background

Advancements in the last decade have allowed for the commercialisation of Cone Beam CT (CBCT) imaging. CBCT provides 3D images which can be reconstructed into multi-planar images. (Angile, 2013) Needle guidance software combines 3D CBCT imaging with needle trajectory planning software and real-time fluoroscopy imaging. The use of CBCT and needle guidance software can negate the use of the traditional CT fluoroscopy based examination.

How it works

A Cone Beam CT of the area under examination is performed. Needle guidance software then allows for accurate planning of needle guided interventional procedures. Whereby the operator plans out the needle path from the lesion to the proposed skin entry point, avoiding any vital anatomical structures. The imaging system then calculates the optimal imaging angulations (progression views); the 3D dataset and virtual trajectory are co-registered. This allows a needle path to be projected upon the 2D fluoroscopic image.

Procedures

Needle guidance software can be used for a variety of procedures including:

- Vertebroplasty
- Kyphoplasty
- Biopsies
- Drainages
- Injections
- Ablations

Advantages| Disadvantages
---|---
A single imaging orbit can produce a complete volume dataset, allowing for Submillimetre isotropic reconstructions can be created (Orth et al, 2008) | Operator dependent need high levels of skill and knowledge
Patients can remain stationary throughout. | The is also the radiation implications to consider – ALARA and Radiation Protection
Both fluoroscopic (Fig 3) and needle guidance (Fig 4) are available as separate images to allow for evaluation of needle progression - this is not limited to any plane of imaging e.g. Axial only imaging within CT | Patient movement impacts on needle guidance in 2 main ways.
Easy access to patient for drug and care administration | 1. Fitly the time for imaging system to complete the volume data set for the CBCT/3D dataset is longer than a conventional CT scan.
More space for the Interventional radiologist to work | 2. If the patient moves the 2D fluoroscopic image will be accurate were as the needle guidance virtual trajectory will no longer relate to the new patient condition.
Compact design | Real time fused CBCT, Needle guidance and fluoroscopic image allow for accurate needle placement (Fig 5).

Conclusion

The use of needle guidance software has allowed the Interventional Radiologist to perform examinations that were once only possible CT to be performed within Interventional Suites. This allows for better management and care of the patients, by facilitating improved access to the patient throughout the procedure but also easy access to the staff and facility’s that an IR suite provide. The successful use of Needle Guidance Software is down to confidence, knowledge and skill base of operator and the radiographer. As with all new technologies, the more experience and practise gained, the better the performance outcomes will be.

References


Submitted as part of PGCert module – Interventional Radiological Studies
Any questions or queries: Stephanie.Dobson@Aintree.nhs.uk