

## ABSTRACT

**Background:** Carotid plaque burden (CPB) is an surrogate marker for the risk of cardiovascular events. Its assessment with standard, two-dimensional ultrasound can be challenging while other imaging techniques require the use of contrast agents and radiation.

**Methods:**

We used an add-on tracking/processing system together with a conventional ultrasound machine to acquire multi-planar imaging datasets. These were analyzed off-line to measure the carotid plaque burden.

**Conclusions:**

Tomographic ultrasound (tUS) offers a fast, cheap and accurate imaging techniques for the assessment of carotid plaque burden without the need for contrast agents or radiation.

## BACKGROUND & PURPOSE

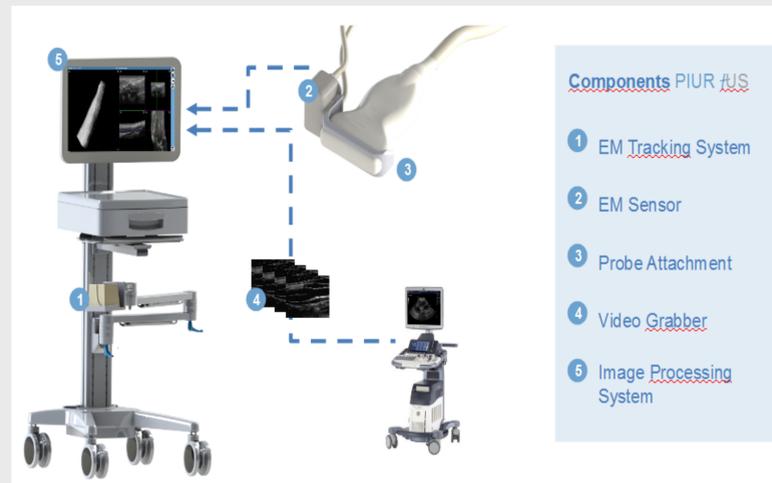
CPB has proven to be a strong predictor for cardiovascular events (H. Sillesen et al, JACC 2012). It can be assessed by different imaging techniques like CT, MRI and (standard) ultrasound. These need contrast agents or radiation, are time-consuming with high technical requirement or tend to be inaccurate and user-dependent.

Therefore we evaluated tUS as a possible assessment technique combining the advantages of ultrasound diagnostics with a 3-dimensional and highly reproducible analysis.

## METHODS

We used a setup with a standard ultrasound-system (Siemens Acuson s2000) and an add-on tracking/processing system by piur Imaging. Patients with a cardiac defibrillator were excluded for safety reasons. The carotids of 25 patients with mild to severe degree of stenosis were scanned.

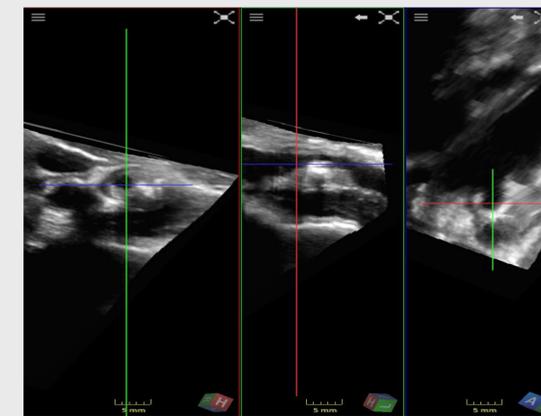
Figure 1: Components



This setup uses a weak magnetic field in combination with an EM tracking sensor mounted on the ultrasound probe to acquire tomographic, multi-planar data sets with a spatial resolution around 0.1mm. The examination was conducted performing a sweep across the carotid with a relative speed of approximately 1cm/s.

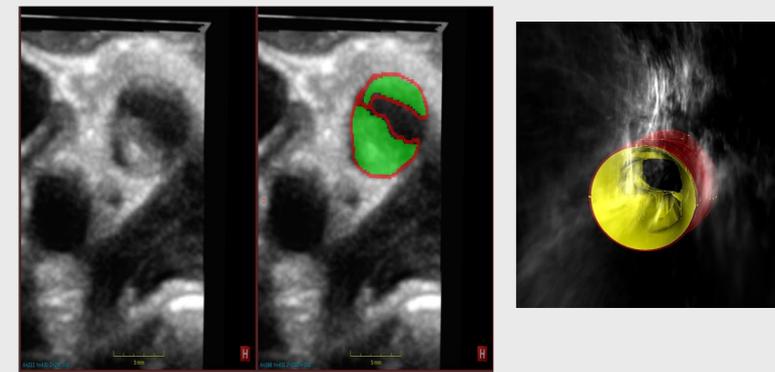
## METHODS

Figure 2: Tomographic ultrasound imaging

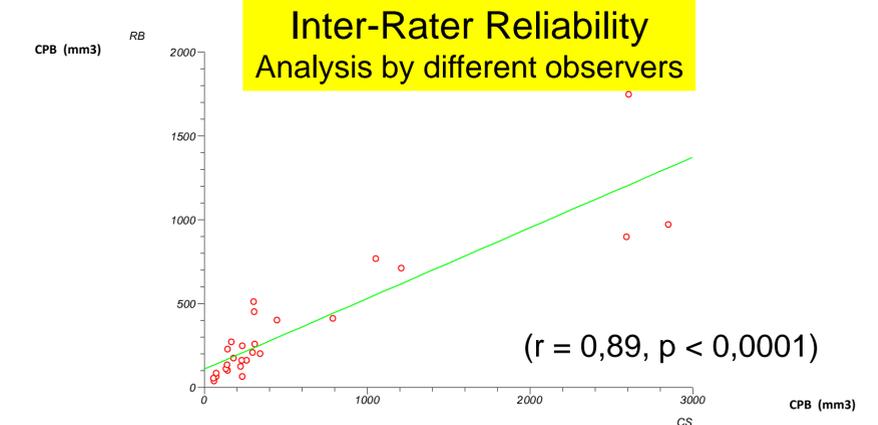


After data assessment an off-line analysis software (ImFusion Suite) was used to segment the plaque semi-automated, a 3D reconstruction and thus calculate the carotid plaque burden as volume of the examined plaque. The analysis was performed separately by two blinded investigators

Figure 3: Plaque segmentation and 3D reconstruction



## RESULTS



Assessing CPD with tUS showed good inter-rater reliability ( $r=0,89$ ) after analyzing 25 examinations ( $392 \pm 262 \text{mm}^3$  vs.  $367 \pm 239 \text{mm}^3$  CPB per examination,  $p=0,41$ ).

The ultrasound examination time was approximately 1 minute while the offline-analysis took between 5 and 10 minutes depending on plaque mass and configuration.

## CONCLUSION

The assessment of CPB with tUS

- offers high spatial resolution (slice thickness ~0.1mm)
- avoids the use of contrast agent or radiation
- is fast (~1min acquisition, 5-10min analysis)
- is rather cheap
- is limited by calcification/acoustic shadowing
- has a high inter-rater reliability

## DISCLOSURES

I have no disclosures.