071 **ELASTOGRAPHIC STUDY OF INJECTION.**

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Background: Sonography is used in many medical procedures involving needle insertion into tissue. In some of these procedures, the aim is to guide the needle tip to a certain location in tissue for biopsy, injection or seed placement. In other procedures, the study of the injectate, such as its spread, is of interest. B–mode and Doppler imaging have been used for this purpose.

Aims: In this study, we examine the feasibility of monitoring injection using elastography. Of special interest is distinguishing the depot (the area where the injectate is deposited) from surrounding tissue.

Methods: Fresh lamb leg–muscle tissue is used for the experiments. A mechanical apparatus previously used for vibrating tissue in elastography studies is modified to move the plunger of an epidural glass syringe. This type of syringe has very low friction and is apt for controlling the position of the plunger. Degassed water is injected with an oscillatory motion of the plunger under computer control. Elastography images are taken using real–time elastography software developed at our lab [1] running on an Ultrasonix Sonix RP machine. A linear probe is used, and axial strain images are captured.

Results: Figure 1 shows successive axial strain images taken during a typical experiment with a ramp input. Figure 2 shows typical results with oscillatory inputs. The pure black areas of the images correspond to areas where the correlation between the RF data was less than 80%. As the entry of injectate alters the echogenicity of the tissue, the correlation between successive RF data is lost, and, thus, the depot appears as a black region. Moreover, because of the pressure caused by the depot, strains can be observed in surrounding tissue. The real–time capture allows both temporal and spatial analysis.

Conclusions: We have demonstrated the conceptual feasibility of injection studies using elastograms. The depot can be distinguished from the surrounding tissue using correlation data. Strains caused by the injection in surrounding tissue can be observed and measured using the elastogram. This study shows that elastogram can be used for a variety of purposes in the medical procedures mentioned in question. On–going experimentation is focused on further quantification. Needle tip tracking, avoiding pain and tissue damage during injections by limiting the strains, and characterizing mechanical properties of surrounding tissue, such as elasticity and porosity are some of the applications we are scrutinizing.

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References:

[1] R. Zahiri-Azar, S. Salcudean, "Motion Estimation in Ultrasound Images using Time Domain Cross Correlation with Prior Estimates", IEEE Transactions on Biomedical Imaging, Volume 53, Issue 10, Oct. 2006 Page(s):1990–2000.

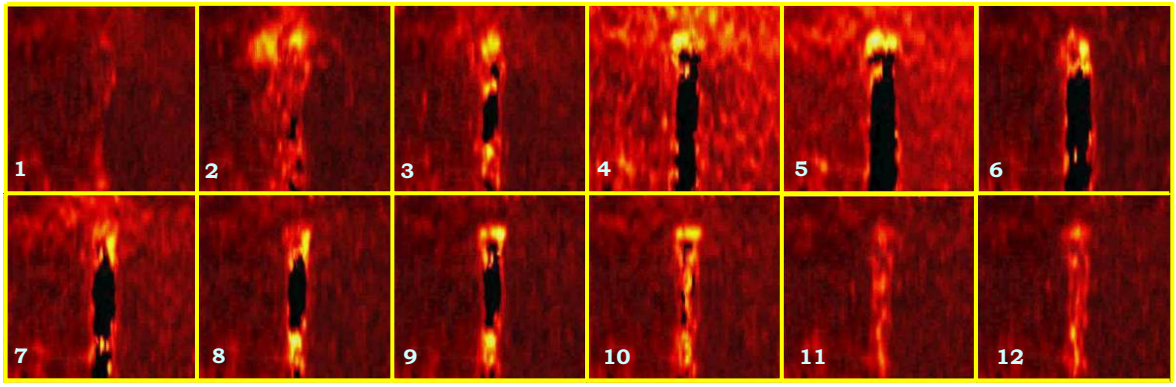

Figure 1: Successive snapshots of axial strain measurements during injection using a ramp input.

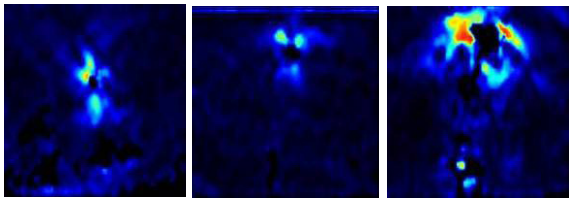

Figure 2: Snapshots of axial strain measurements during injection using oscillatory inputs.