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Transperineal Freehand US/MRI Fusion Target Prostate Biopsy using the Esaote Mylab™9 System: A Step by Step Guide

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ABSTRACT

Objective: To document a step-by-step guide of transperineal Freehand US/MRI fusion target prostate biopsy using the Esaote MyLab™9 System.

Setting: "San Pio" Hospital of Castellaneta, Italy.

Patients: The patients undergoing this procedure had a suspicion of prostate cancer based on a mpMRI of the prostate.

Results: No major complications were seen during and after the biopsy, and the patients were discharged 30 minutes-1 hour after the procedure.

Conclusions: Fusion-targeted biopsy has proven to be better than random technique for both biopsy-naïve and previous negative biopsy [1]. With a standardized step-by-step approach the procedure can give good detection rate results with little or without discomfort for the patients and with short operating times.

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Introduction

The prostate biopsy is considered the gold standard technique for Prostate cancer (PCa) diagnosis. Only ultrasound (US) guiding is largely criticized for its low sensitivity in the detection of suspected PCa lesions (SL).

Actually US/MRI fusion-targeted biopsy has proven to be advantageous over standard practice for both biopsy-naïve and previous negative biopsy [2].

The US/MRI fusion was initially performed in a cognitively approach. Soon, systems providing a computerized US/MRI fusion process were introduced in clinical practice with the aim to optimize the fusion process.

Prostate biopsy may be performed by transrectal or transperineal way.

The available evidence demonstrates that the transrectal approach should be abandoned in favour of the transperineal approach beacause of infectious complications [3].

MRI-targeted biopsy can be obtained through cognitive guidance, US/MR fusion software or direct in-bore guidance. There is not shown a clear superiority of one image-guided technique over another [4].

We present a step-by-step guide of transperineal Freehand US/MRI fusion target prostate biopsy using the Esaote MyLab System in patients undergoing loco-regional anesthesia.

Procedure with Esaote Mylab™X9 System® : Transperineal Freehand US/MRI Fusion Target Biopsy

There are many types of fusion systems and we used Esaote MyLab™9 system® : Transperineal Freehand US/MRI fusion target biopsy.

This is a US system that allows you to import MRI data sets.

Place the Biopsy Targets on the mpMRI Lesions

Before starting the procedure it is advisable to view the CD of mpMRI on the computer to identify well the targets described by the radiologist.

The radiologist should have described the localization of the lesions on a diagram representing McNeal's anatomy of the

prostate, but in doubtful cases they can be discussed first with the radiologist.

The procedure can begin by inserting a CD-ROM with the mpMRI exam in the CD player. It is possible to select and import more sequences (for exemple axial T2 sequence, sagittal T2 and DWI) on which the medical opearator can identify the lesion to be sampled (Figure 1).

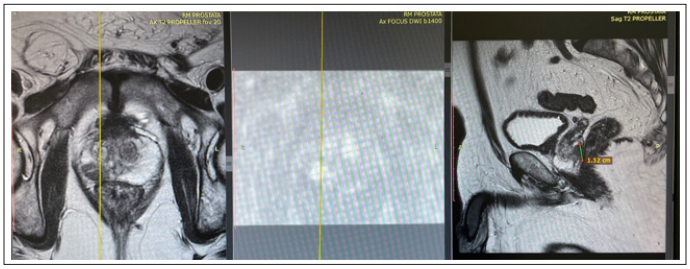

Figure 1: mpMRI Sequences (In Order from Left to Right: Axial T2, DWI and Sagittal T2)

The lesion can be identified using a spherical target. If the lesion has not a spherical shape we can use more targets of the same color itersected to make a different shape of the target.
We can put multiple targets based on how many lesions are described on mpMRI.

Patient Preparation and Local Anaesthesia
Prior negative mid-stream urine test and routine surgical disinfecting preparation of the perineal skin are mandatory. Antibiotic prophylaxis consisted of a intraoperative single dose EV of cephazolin if the patient was not allergic to beta-lactams [5].

Patients are placed in the lithotomy position.

After careful disinfection of the perineal skin with iodopovidone we make Ultrasound-guided local anaesthesia with peri-prostatic block, using Lidocaine and sodium bicarbonate [6].

With the aid of TLC 3-13 Bi-Plane endocavitary probe, US images are displayed and the transperineal anesthetic is applied (via 22 G spinal needle) with two bilateral paramedian accesses from the median raphe approximately 1,5 cm from the anal orifice (Figure 2).

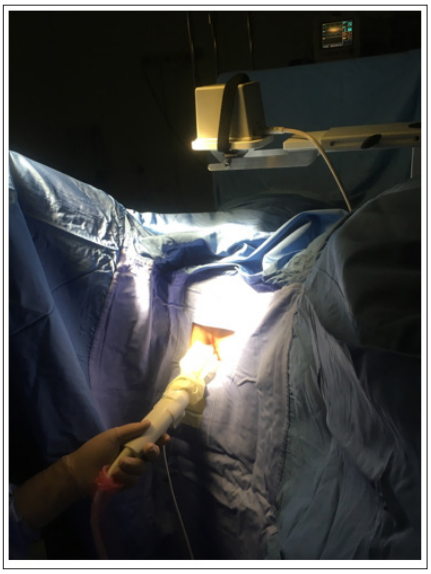

Figure 2: Ultrasound-Guided Local Transperineal Anaesthesia

MRI and Ultrasound Images Collimation
With the aid of anatomical landmarks, the ultrasound images are collimated with those of MRI. At this moment, the AQUIRE button displays the fused US/MRI images.

Real-time fusion is achieved through continuous communication between the US probe equipped with a tracking device and a magnet that is placed near the patient's abdomen to verify the real-time, the spatial coordinates of the biopsy needle and the virtual targets to be biopsied.

After successful fusion is achieved, the display shows one fused image representing real-time US/MRI overlapping and It can be changed manually to allow the clinician to choose the intensity of the US or MR images displayed. The FINE-TUNING function allows restoration of the fused US/ MRI images when the fusion quality is lost due to possible movements of the patient.

Biopsy Sampling
Two 15-Gauge cannulas are placed about 1 cm bilaterally to the perineal raphe to allow easy access to the 18 G, 20 cm biopsy needle. The patient's movements lead operator to readjust the US/MR image fusion during the exam, therefore it is reasonable to perform the target sampling before the random sampling.

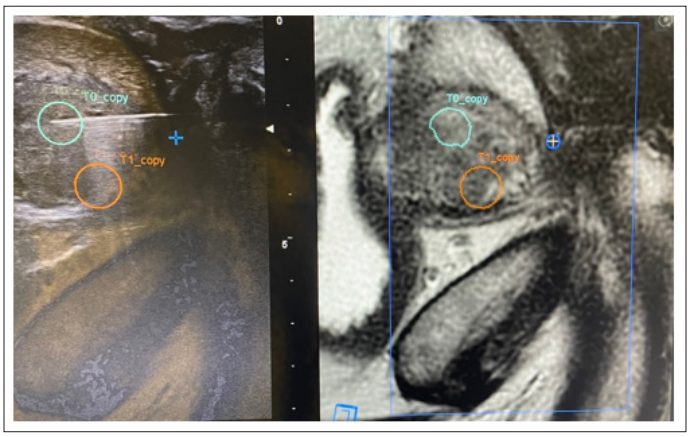

Figure 3: The Ultrasound Display shows the Ultrasound Image with Virtual Targets in Real Time on the Left and the mpMRI Image on the Right. The Hyperechoic Line in the Left Image is the Biopsy Needle During Sampling on a Target

Each Fusion biopsy was performed by using a Tru-Cut 18-Gauge needle, performing a sampling of three frustles for each target, except for the target only re-biopsies (Figure 3).

At the end of target sampling a random bilaterally sampling was performed in all the patients unless for re-biopsies cases or cases of performing only target biopsies for other reasons.

Results
The total operating time was estimated to be about 10 minutes. There were no intraoperative major complications, and the patients were discharged about 30 minutes-1 hour after biopsy. The step-by-step procedure detailed above, showed the steps needed to standardise the biopsy.

Discussion
With a standardized step-by-step approach the Fusion biopsy with Esaote MyLab System can give good detection rate results, little discomfort for the patients and it can be performed in short operating times in an outpatient setting.

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