OPTIMIZATION OF FIXATION AND PROCESSING OF BIOPSY GUN PROSTATE NEEDLE BIOPSY SPECIMENS

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Abstract

Background: Consistency of nuclear and cytologic detail in prostate needle biopsy specimens is a critical aspect of histopathologic diagnosis. The preanalytic parameters of formalin fixation from time of surgical procedure are largely uncontrolled and inadequate fixation may contribute to less than optimal histology when using same-day rapid tissue processing. To accommodate this unstandardized variable by defaulting to overnight fixation of Biopty gun prostate needle biopsies negates the advantage of rapid cycle processing.

Design: We performed Biopty Gun (Bard Peripheral Vascular, Inc. Tempe, AZ) needle biopsies of fresh clinical prostatectomy specimens to test 18 pathway variations of tissue fixation and processing. Needle (18G) cores obtained from the posterior aspect of glands (8 per side) were 1 mm or less diameter and averaged 15-18 mm length. To control for variation in fixation time and mimic air-drying, cores were placed on saline soaked gauze initially before testing combinations of no fixation other than on processors, timed tissue fixation at room temperature, desktop microwave formalin fixation for 3.5 minutes (Model EBS42850, Energy Beam Sciences, East Granby, CT), controlled heated fixation for 30 minutes at 37° , 45° and 50° C (FixMate, Milestone Medical Technologies, Inc, Kalamazoo, MI/Sirasole, Italy) and processing on two microwave enhanced instruments, Tissue-Tek Xpress (Sakura Finetek USA, Inc, Torrance, CA) and Pathos DELTA (Milestone Medical Technologies). Quality assessments were made of ease of embedding and microtome sectioning and histopathologic variables of hematoxylin and eosin staining intensity, homogeneity, nuclear preservation, nucleolar prominence, autolysis or thermal artifact. Microscopic sections were evaluated by one GU pathologist. Microscopic quality was scored on a 10-part scale.

Results: With the exception of the FixMate heated and timed fixation tests at 37° C and 45° C, all combinations gave inconsistent and spotty unacceptable, suboptimal to good microscopic preparations no matter the variable manipulated. The higher 50° C test of heated formalin fixation resulted in an artifact of nuclear chromatin that was dark and smudgy. The histologic quality at 37° C was judged slightly superior to 45° C. No significant difference in quality of tissue microtomy or histologic preparation was noted for either microwave tissue processor.

Conclusions: Enhanced consistency in the quality of histologic preparations using rapid microwave processors is obtained when prostate needle biopsy fixation is standardized with controlled time and temperature of fixation.

Background

- Increased volume of needle biopsy cases and clinician (customer) requests for quicker pathologic diagnoses prompted investigation into reducing the overnight tissue fixation process
- Inadequate fixation contributes largely to less than optimal morphology
- Needed to develop a method to optimize fixation without compromising morphological appearance on the glass slides
- Needle cores obtained from clinical prostates and processed according to three trials
- Trial1- five needle core samples, Trial 2 with four core samples and Trial 3 with eight core samples (Fig. 1)
- All cores microscopically evaluated as a six point scoring scale

Materials and Methods

- Process flow maps created to understand pre trial condition
- All needle cores are retrieved fresh from clinical prostatectomies for all trials
- All cores evaluated by one GU pathologist
- All trials included the Rapid Microwave technology
- Trial 3, eight needle equally divided and processed in the Xpress and Milestone processors
- All trials microscopically evaluated according the same scale

Lean Design of Experiment

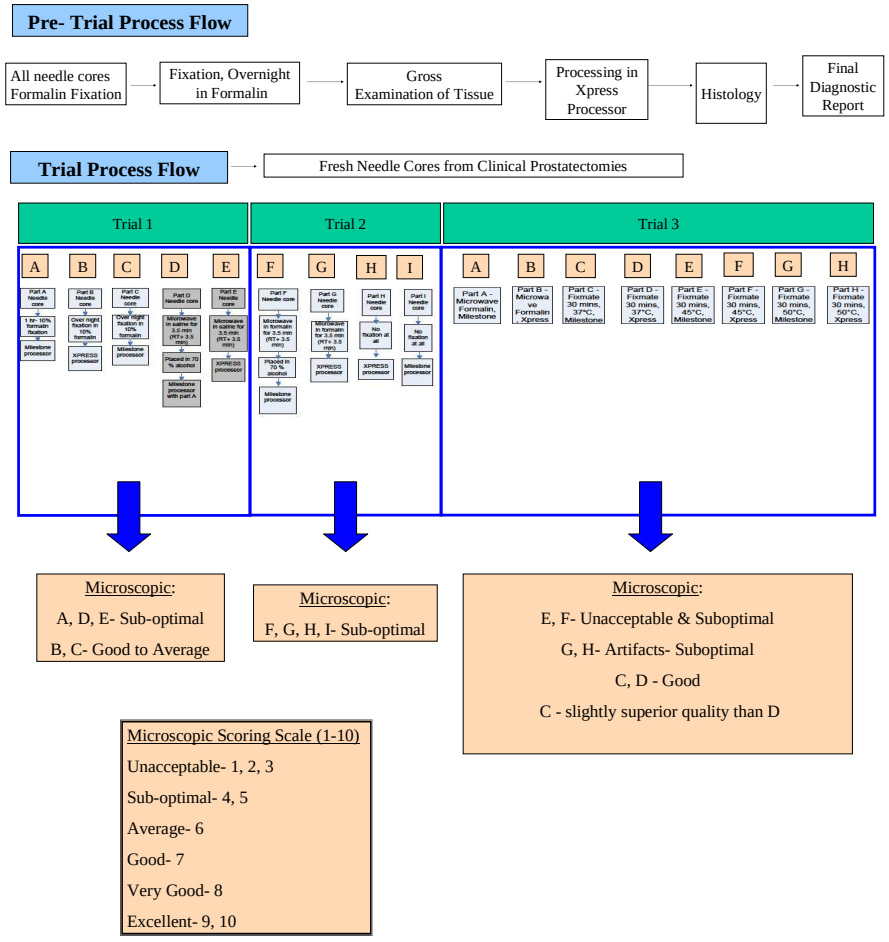

Figure 1. Flow chart diagram of three step trial.

Results

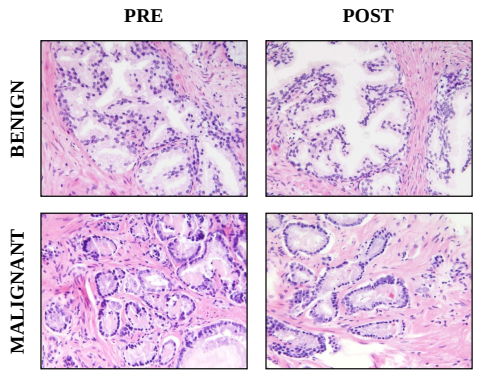

Figure 2. Morphology of the benign and malignant prostate biopsy tissue fixed conventionally (PRE) and using rapid microwave technology at 37^{0}C (POST). Note essential identical microscopic tissue appearance.

Conclusions

- A 37^{0}C formalin fixation temperature provides a slightly superior quality of histologic section than at 45^{0}C or 50^{0}C
- Enhanced consistency in the quality of histologic preparations using rapid microwave processors is obtained when prostate needle biopsy fixation is standardized with controlled time and temperature of fixation
- Fixation of prostate needle biopsies can be expedited from overnight to same day processing

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