Original Article

Cell and Nuclear Morphology Under the Microscope: Traditional vs. Microwave Tissue Processing

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Abstract

Background: Traditional tissue processing methods are time-consuming and labor-intensive, whereas the advanced microwave technique offers greater efficiency in both time and manpower. It enables faster slide preparation with minimal artifacts and reduced tissue shrinkage. **Material and Methods:** After all the paired samples were processed using both conventional and microwave method of tissue processing, they were evaluated for cellular and nuclear morphology simultaneously by an independent observer. **Results:** In this study, by microwave method,96% of the slides showed distinct nuclear morphology while 94%of the slides showed distinct cellular morphology when compared with conventional methods. **Conclusion:** The histologic material reproduced by microwave method was of desirable quality when compared with the conventional method of tissue processing.

Keywords: Nuclear morphology, cell morphology, microwave tissue processing.

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Introduction

Embedding the tissue in a solid medium that is both firm enough to support it and rigid enough to section it into desired thicknesses while simultaneously keeping it soft enough for a knife to cut through it without causing damage is known as tissue processing. Processing the tissue makes it simple to view it under a microscope and examine the distinctive characteristics of the different cell organelles.[1]

Standard histology techniques rely on the gradual diffusion of solutions from the exterior surfaces, which, if heat is applied, move through the specimen's interior by thermal conduction. When thin portions of a specimen are exposed to microwave energy, the entire specimen is impacted instantly and simultaneously, allowing solutions to exchange and accelerating the rate of reaction because of the heat produced internally.[2]

Numerous areas of histology and histopathology have made use of microwaves, including fixation, histoprocessing, fast staining of routine, metallic, and fluorescent tests, as well as light and electron microscopic investigations.[3]

Traditional tissue processing methods are time-consuming and labor-intensive, whereas the advanced microwave technique offers greater efficiency in both time and manpower. It makes it possible to prepare slides more quickly with fewer artefacts and less tissue shrinkage.

The purpose of this study is to compare both conventional method and microwave method of tissue processing as well as to compare the quality of the slides produced by both methods

Materials and Methods

A comparison analysis was carried out in the laboratory for histology in the Department of Anatomy, K. S. Hegde Medical Academy, Mangalore. A sample size of 50 paired slides, 50 conventional and 50 microwave, measuring 1 cm by 1 cm and including no bony components, were created. The slides were between 5 and 8 mm thick.

Inclusion Criteria:

Tissues were randomly chosen from well embalmed cadavers

Exclusion Criteria:

Grossly damaged and pathological tissues were excluded.

Photographs were taken for documentation.

After all the paired samples were processed using both conventional and microwave method of tissue processing, they were evaluated for cellular and nuclear morphology simultaneously by an independent observer.

The slides processed by conventional method was labelled as A and the slides processed by microwave method was labelled as

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B.

The observer was unaware of the method of processing used during evaluation of the cellular and nuclear morphology of the slides.

Criteria for evaluation of the slides:

1. Cellular morphology was assessed by the clear outline of the tissue architecture and clear nucleus and cytoplasm contrast. If the features were clear, it was termed distinct and if it was unclear, it was termed indistinct.
2. Nuclear morphology was assessed by the presence of a prominent nuclear membrane and clear staining of the nucleus. If the features were clear, the slides were classified as distinct and if unclear, they were indistinct.

Gathering and documenting information:

1. Microsoft Excel was used to record the data.
2. SPSS software version 22.0 was used for statistical analysis, and the findings were tabulated.
3. Pearson Chi-square test was done to compare the cellular and nuclear morphology of the slides prepared by both approaches.
4. Statistical significance was defined as a "p" value of less than 0.05.

Ethical clearance: The study was authorised by the Institution Ethics Committee.

Staining: The standard process of haematoxylin and eosin (H&E) of staining was done equally to all 100 slides.

Results

[Table 1] shows that the cell morphology of the slides is better in microwave processed slides than the conventionally processed slides. The p value was .461 which is statistically insignificant.

Table 1: The comparison of the cell morphology of the slides obtained using both traditional and microwave methods (Pearson Chi-square test)

		Method		Total
		Conventional	Microwave	
Cell morphology	Indistinct	5 10.0%	3 6.0%	8 8.0%
	Distinct	45 90.0%	47 94.0%	92 92.0%
Total		50 100.0%	50 100.0%	100 100.0%

Table 2: The comparison of the nuclear morphology of the slides obtained using both traditional and microwave methods (Pearson Chi-square test)

		Method		Total
		Conventional	Microwave	
Nuclear morphology	Indistinct	4 8.0%	2 4.0%	6 6.0%
	Distinct	46 92.0%	48 96.0%	94 94.0%
Total		50 100.0%	50 100.0%	100 100.0%

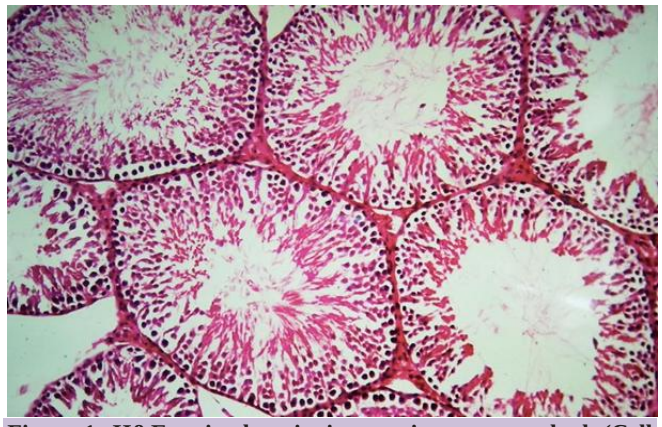

Figure 1: H&E stained testis tissue, microwave method. (Cell and nuclear morphology of the slides is better in microwave processed slides than the conventionally processed slides).

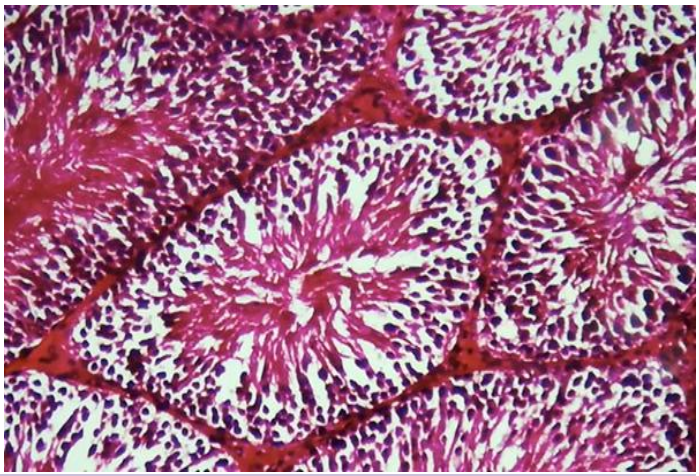

Figure 2: H&E stained testis tissue, conventional method

[Table 2] shows that the nuclear morphology of the slides is better in microwave processed slides than the conventionally processed slides. The p value was .400 which is statistically insignificant.

Discussion

Various studies have been done by researchers and scientists to discover new and rapid methods of tissue processing to enable same day results. Thus, the microwave method of tissue processing was devised to save time as well as to produce

comparable slides with minimal differences when compared to conventional methods. One of the oldest studies done in this regard is by Anthony Leong in the year 1985 and Kok and Boon in the year 1986.[4]

In the current study the microscopic quality of the slides obtained by microwave method was comparable to the ones obtained by conventional method. The morphology and architecture of the tissues was well preserved and the same was found to be in the study done by Kok et al.[5]

Out of the 50 slides viewed 94% of the slides showed clear and distinct cellular features while 96% of the slides showed clear and distinct nuclear features. The microwave processed tissue sections had comparable cytoplasmic and nuclear details with good and clear nuclear and cytoplasmic contrast similar to the sections obtained from conventional method. It wasn't possible to differentiate between the two methods by observing the tissue sections. This finding is in accordance with the studies done by Morales et al,[6] Mathai AK et al,[7] and Rohr et al.[8]

Chaudhari et al,[9] and Morales et al,[6] found in their studies that the nuclear and cytoplasmic architecture were same when slides by both methods were examined under the microscope which was also seen in the current study.

The staining quality of the slides by microwave and conventional method did not differ in the current study. The hematoxylin and eosin contrast were in the right amount. These findings are in accordance with studies done by Boon et al,[10] Morales et al,[6] and Chaudhari et al.[9]

In the current study it was observed that in the tissues processed by the microwave method, the overall architecture of the cells was well preserved and nuclear cytoplasmic contrast was well appreciated. Tissue shrinkage was found to be minimal whereas in the conventional method it was more pronounced. But this did not seem to affect the staining quality of the slides prepared from both methods when examined under the microscope. Tissue shrinkage could be mainly due to the dehydrating effects of alcohol.[11]

Microwaves are useful in tissue processing especially because they speed up the time-consuming process. Overall, it takes about 2 to 3 hours including fixation, processing, sectioning and staining. It eliminates the use of toxic xylene thereby reducing its exposure. It can also be used to replace normal formalin fixation using 1M saline instead.[12]

Conclusion

The histologic material reproduced was of desirable quality when compared with the conventional method of tissue processing. The staining quality was also comparable and similar that the slides could not be differentiated which method was employed for tissue processing. In this study, by microwave method,96% of the slides showed distinct nuclear morphology while 94%of the slides showed distinct cellular morphology when compared with conventional methods.

The microwave technique can be adopted in the histology laboratory on a regular basis since it shortens the time taken for processing the tissues and yields good comparable results with the gold standard of routine conventional method.

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Conflicts of interest

There are no conflicts of interest.

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