Evaluation of the Leica PELORIS Dual Retort Rapid Processor

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Abstract

In the fall of 2008 The Ottawa Hospital conducted a comparison of two fairly new to the market tissue processors against the processors in use at the institution at that time. The primary requirement for the selection of instruments for comparison was that the instrument and the technology be compliant with guidelines and recommendations for the processing of tissue to be used in category II immunohistochemical testing; ER/PR, Her2neu and CD117. The PELORIS Dual Retort Rapid Tissue Processor was selected as one of the instruments to take part in this comparison trial.

The selection of new equipment for histology/pathology has changed significantly in the last few years. In the past the ability to process tissue adequately on an overnight run and the cost of the instrument were the primary concerns when evaluating a tissue processor. The current atmosphere of reduced turnaround times, rapid diagnosis and increasing work capacity without increasing staff or physical space has presented new challenges. Another major consideration in selecting a new instrument is the hands-on involvement that The Occupational Health and Safety Departments are taking in evaluating equipment for both chemical exposure to staff and the ergonomics of operating the instrument.

A set of tests and evaluations were developed to address as many of the selection criteria as thoroughly as possible in the approximately 6 weeks that the instruments would be on site. All of the technical staff from the histology laboratory were given an opportunity to use the instruments in some capacity, all staff took part in the embedding, cutting and evaluation of the tissue blocks produced on the instruments. The blocks were inspected at 1, 3 and 6 months for evidence of inadequate dehydration, clearing and infiltration of the tissue during the tissue processing. The H&E slides produced from the multiple processing runs on the different processors were presented to several pathologists for a blind study evaluation of the integrity of tissue architecture and quality of the H&E stain.

Evaluation Criteria and PELORIS Assessment:

The overall construction of the instruments was assessed. The use of rapid processors permits multiple processing runs per day which in turn requires more interaction with the instrument. The weight of the instrument, strength of construction, quality of hinges and latches, seals, quality of finish in the processing chamber(s) and the reagent bottle connections are evaluated with respect to durability.	The PELORIS is rated the highest of the three instruments in this category. The instrument is a very heavy, well constructed unit. Every aspect of the instrument is heavy duty and built for durability. In regions where power fluctuations and outages are common, Leica recommends the installation of an Uninterrupted Power Supply (UPS).
The ease of operation of the instrument, ability to navigate the operating menu and ability to abandon a processing run in the event of an operator error were evaluated with respect to the wide range of staff's computer skills and abilities.	The PELORIS rated the highest of the three instruments in this category. The touch screen is very user friendly, using text, photos, graphics and prompts. The ability to navigate using the top control bar permits easy access to all user functions. The built in prompts when loading and operating the instrument puts the staff at ease.
The ease and time required to maintain the instrument was evaluated taking into consideration the exposure of staff to the reagents/fumes and the bending and lifting required to facilitate the solution change.	The PELORIS rated the highest of all three instruments in this category. The remote Drain/fill, using the hose and snorkel, eliminates the need to decant solutions and makes the changing of reagents, even the wax, a safe and fairly effortless task. A solution can be changed in under 5 minutes on the PELORIS, the remote fill and drain process on one of the other instruments takes over 9 minutes to drain and fill a single reagent. The PELORIS is the only instrument of the three that permits the waste wax to be pumped out of the instrument directly into the waste container, the other instruments require the technician to remove and manipulate a container of 4 liters of molten wax to the waste receptacle.
There was insufficient time to properly assess the reagent management systems and adequately compare the difference between the PELORIS system and the reagent management system that uses onboard monitoring of specific gravity of the solutions.	
To accurately assess the processing ability of the processors, numerous parallel processing runs were performed using comparable factory installed programs on each processor.	The PELORIS was the only processor with a 1 and 2 hour rapid program. A 3 hour program was developed on the PELORIS to match the 3 hour program on the other 2 processors to run biopsies. A 14 hour program was developed for each processor to test the instruments with extreme fatty tissues. Cassette baskets that spaced out the cassettes were used if they were available for the instrument.

Test One

Mock biopsies of varying size were made from fixed breast, bowel, lung and liver tissue. 25 cassettes were processed on each processor on a 3 hour program; an additional 25 cassettes were also processed on both the 1 and 2 hour processing programs on the PELORIS.

This test was conducted at 4 different times over the duration of the comparison trials. The results were consistent over 4 processing runs.

There was no discernible difference in Microtomy, tissue architecture or H&E stain between the three processors using the 3 hour processing programs. The tissue processed on the PELORIS 2 hour program was of the equivalent quality to tissue from the 3 hour processing program. Some but not all of the tissue processed on the 1 hour PELORIS program demonstrated paler staining for both the nuclear and counter stain towards the center of the tissue.

A review of the tissue blocks at 1, 3 and 6 months did not reveal any inadequacies in processing.

Test Two

Sections of tissue of varying size were made from fixed breast, bowel, uterus, lung and liver tissue. 50 cassettes were processed on each processor on an 8 hour and 12 hour program. This test was repeated 5 times over the course of the comparison trial.

There was no discernible difference in Microtomy, tissue architecture or H&E stain between the three processors using either the 8 hour or 12 hour program for the lung, uterus and liver tissue. There was a noticeable difference in quality of processing and the ability to cut an acceptable 3 µm section in the breast and bowel tissue between the 8 and 12 hour program for all three processors. A review of the tissue blocks for the 8 hour processing programs at 1, 3 and 6 months revealed breast and bowel tissue that had dried out and shrunk, indicators of poor tissue processing.

There was a noticeable difference in quality of processing between the processors for the breast and bowel tissue using the 12 hour program. The 5 separate processing runs at 12 hours produced 50 tissue blocks of breast and 50 tissue blocks of bowel for each processor. The PELORIS processor had a reprocessing rate of 3% (2 breast 1 bowel) the other processors had a reprocessing rate of 9% (7 breast 2 bowel) and 11% (10 breast 1 bowel). A review of the tissue blocks for the 12 hour processing programs at 1, 3 and 6 months revealed breast tissue that had dried out and shrunk, indicators of poor tissue processing. PELORIS 1 block, other processors 3 and 2 respectively.

Test Three

Large fatty sections of breast tissue of varying size and thickness were placed into cassettes. Each processor was filled to capacity (220, 240, 250 cassettes) and the tissue was processed on a 14 hour program developed at TOH. This test was conducted twice in the comparison trial.

There was a noticeable difference in quality of processing between the processors for the 14 hour program. The 2 separate processing runs at 14 hours produced 440, 480 and 500 tissue blocks of breast tissue. The PELORIS processor had a reprocessing rate of less than 1% (2 blocks) the other processors had a reprocessing rate of 5% (22 blocks) and 6% (30 blocks). A review of the tissue blocks for the 14 hour processing programs at 1, 3 and 6 months revealed a few blocks of tissue that had dried out and shrunk, indicators of poor tissue processing. PELORIS 0 blocks, other processors 4 and 1 respectively.

Conclusion

Overall the PELORIS Processor produced very good quality tissue blocks on all three tests. The poorer quality on the 1 hour rapid program may be attributed to the size of some of the tissue samples. Overall the PELORIS scored significantly better on criteria built to address our institution's requirements for tissue processing. Of particular interest to our institution was the ability of the PELORIS to provide excellent results when processing large runs of fatty tissue.