On-line Biospecimen Histology Review for Facilitated Biorepository Quality Control (QC) of Research Tissue

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Abstract

Introduction
The Human Tissue Resource Network (HTRN),[1] The Ohio State University Comprehensive Cancer Center, facilitates 2011 NCI *Best Practices for Biospecimen Resources (BPBR)*[2] compliance for the AIDS and Cancer Specimen Resource (ACSR/NCI)[3-5] and Cooperative Human Tissue Network (CHTN/NCI).[6] BPBR specifies QA/QC should be customized to assure that "accurate data accompany biospecimens….for research purposes". BPBR specifies that biorepositories use Standard Operating Procedures (SOP) for biospecimen quality including confirmation of histopathology diagnosis. HTRN/ACSR/CHTN developed and deployed a facilitated on-line pathologist/technologist review/release SOP for research tissue QC.

Method
We integrated digital images (Scanscope, Aperio, Vista, CA) of QC tissue, de-identified pathology reports and image analysis detection of percent region of interest (%ROI) using an algorithm trained to recognize 8 tissue classes (Tissue Studio software, Definiens, Munich, Germany) together into a web-based pathology management system (Spectrum, Aperio). The colored ROI visual map can indicate 3 tumor types, glands, necrosis, blood, normal tissue and white space. This integrated system functions on-line for technical and pathology review of QC results before acceptance of procured tissue into a biorepository (ACSR) or release of prospectively procured tissue (CHTN) to investigators. On-line assembled data is reviewed and enriched by technical personnel who flag problem samples. Pathologists review the on-line visual and numerical %ROI data, complete data fields as needed and release or reject samples.

Results
Our facilitated on-line QC process improves turnaround time (3 vs. 10 days) to complete tissue review, reduces pathologist's time and paperwork and generates a permanent, easily accessible, secure QC record. The included tissue digital image, 12 text data fields with 42 data drop down elements, complete ROI map of the image and attached pathology report file constitute a unified record of individual tissue specimen quality.

Conclusion
This technologist/pathologist on-line QC method improves QC data for internal and researcher review of biospecimen quality.

Background

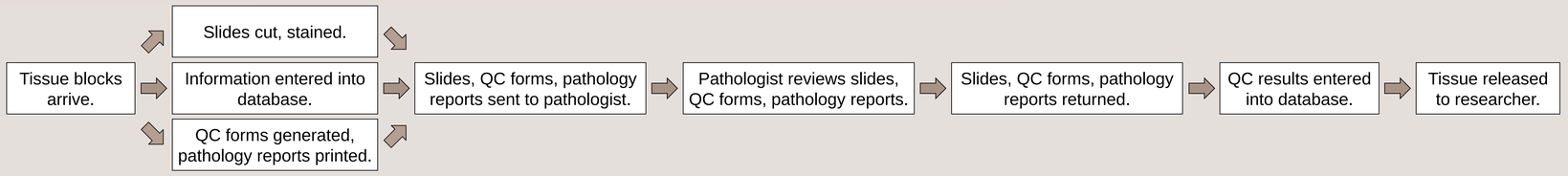

Figure 1: Manual (replaced) process for QC of released tissues. H&E stained tissues marked for TMA on glass if appropriate. Glass has to be pulled for TMA production.

Method

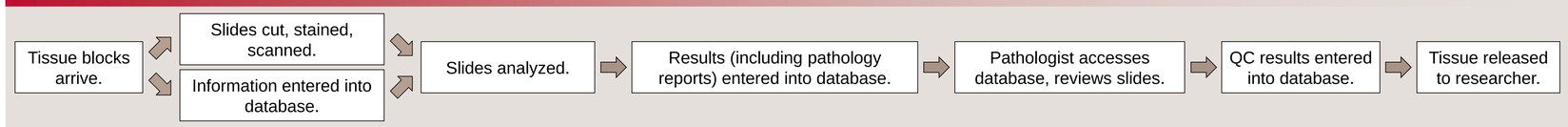

Figure 2: Web-based process for quality assessment and investigator use. On-line record complete for subsequent production of TMA , microdissection for DNA and review.

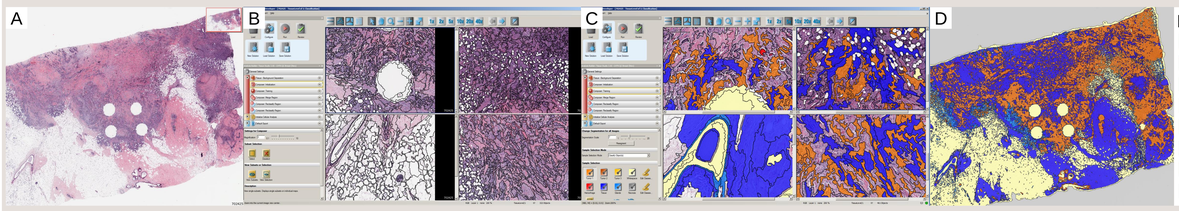

Figure 3: Slide H&E tissue image (A) is used to train Tissue Studio for segmentation (B) and categorization (C). The algorithm can then be applied to this image (or others) to produce a final categorization map (D) which color codes each of 8 categories. Category key above.

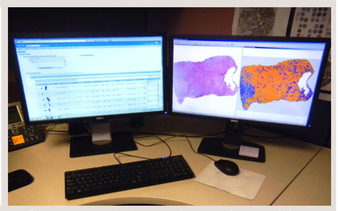

Figure 4: QC work station with tissue review web page (left) and tissue/ROI map (right).

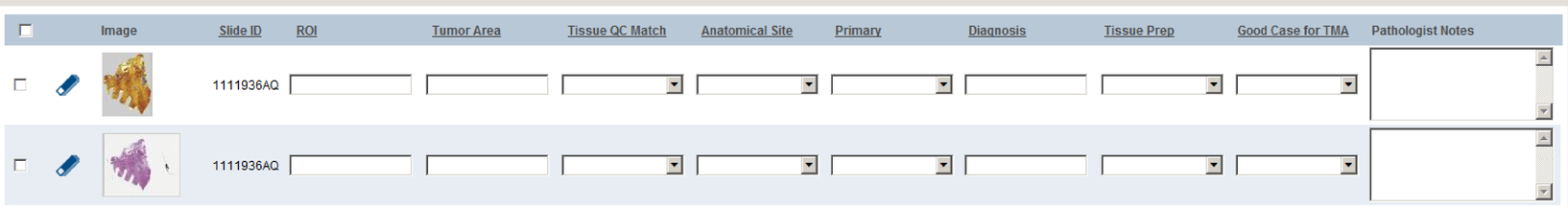

Figure 5: QC tissue review web page in Spectrum has 12 text data fields and 42 data drop down elements. Users can access tissue image and category map using thumbnails.

Results

- QC is performed via web without sending physical material.
- Paper filing system eliminated.
- Pathologist time and paperwork reduced.
- Digitized record keeping retains more detail.
- Permanent, accessible, secure, unified QC record.
- Turnaround time improved (3 vs. 10 days) speeding release of tissues.

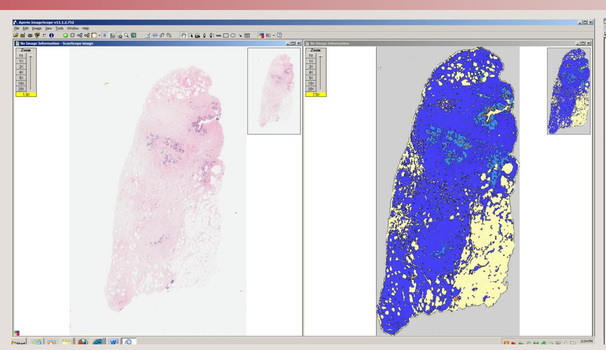

Figure 6: Normal tissue: slide image (left) and ROI/category map in ImageScope (right, see Figure 3 key).

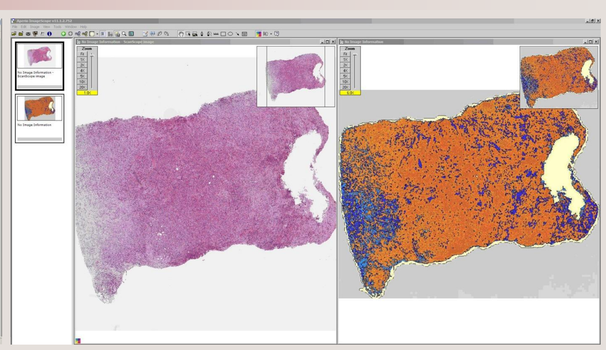

Figure 7: Malignant tissue: slide image (left) and ROI/category map in ImageScope (right, see Figure 3 key).

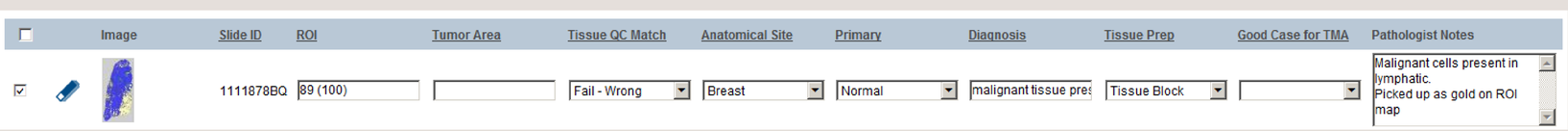

Figure 8: Example of results gathered in QC tissue review web page in Spectrum.

Results (cont.)

Selected data field	*Allowed values*
Tissue QC Match	Pass
	Fail - Wrong
	Fail - Benign
	Fail - Normal
	Fail - Insufficient
	Fail - Other
Anatomical Site	Adrenal
	Bladder
	Brain
	…
Primary	Normal
	Benign
	Primary
	Disease
	Metastatic
	Unknown
Tissue Prep	Tissue Block
	Frozen
	Frozen OCT
	Needs Review
Good Case for TMA	Yes
	No

Table 1: Selected QC tissue review web page data fields and allowed values.

Conclusions

- This technologist/pathologist on-line QC method improves QC data for internal and researcher review of biospecimen quality.

Acknowledgements

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References

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