POSTERS

APPLICATION OF AN AI-BASED WORKFLOW FOR THE ASSESSMENT OF TESTICULAR DAMAGE IN DOGS

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Accurate assessment of canine testicular morphology is essential in reproductive pathology, yet conventional microscopy remains constrained by inter-observer subjectivity. In this study, we developed an AI-based workflow for the automated analysis of digitized H&E and Toluidine blue (TB) stained Whole-Slide Images (WSIs), targeting two critical endpoints: spermatogenic status assessment via Johnsen's Score System and sperm quality evaluation. To this aim, 60 testicular WSIs underwent a multi-step preprocessing pipeline encompassing tissue detection, saturation-based tile extraction, quality control and stain normalization, yielding 218,562 informative tiles classified as follows: 1) normal spermatogenesis, 2) mildly altered spermatogenesis; 3) severe impairment of spermatogenesis. Deep morphological features were extracted using EfficientNet-B4 as a pretrained convolutional backbone. The resulting embeddings were evaluated across four classification frameworks: Random Forest, XGBoost, Multi-Layer Perceptron and a novel Dual-Stack Ensemble combining MLP and XGBoost via soft voting. In parallel, sperm smears stained with TB were used to assess sperm chromatin condensation through an automated whole-slide image analysis pipeline based on k-means clustering. Overall, the ensemble achieved the best performance on an independent test set, with 88.39% accuracy and a weighted F1-score of 0.79. Class-specific analysis showed 86% recall for mild lesions and 82% for impaired spermatogenesis, while ROC analysis yielded AUC values ≥0.92 across all categories. TB analysis revealed a progressive alteration of chromatin condensation across histopathological groups, with increased dark-blue nuclei in severely damaged samples. K-means clustering showed high robustness and reproducibility, supported by a silhouette coefficient of 0.60 ± 0.09 and an adjusted Rand index of 0.89 ± 0.03. In conclusion, the proposed AI- based workflow enables the automated and reproducible assessment of canine testicular damage by integrating histological classification and cytological sperm quality analysis.