Tablet based digital-microscopy as a telemedicine platform for remote cytology and disease surveillance

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Hypothesis

The Cellscope microscope can be used to image blood films of domestic animal species with the fidelity to perform accurate complete blood counts (CBC), and these diagnostic images can be acquired and transmitted to hematology and clinical pathology experts to facilitate disease monitoring and/or emerging pathogen surveillance in remote locations.

Background

- The Cellscope we used is a compact, prototype portable microscope for field applications.
- This Cellscope uses a single 40X objective and allows for integrated imaging and image transmission.
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- Remote areas of Mongolia have limited access to healthcare but growing livestock populations2.
- The Ministry of Health of Mongolia has identified the need to study diseases of livestock; in particular, tick borne diseases3.

Methods

- Blood was collected from 181 animals (15 horses, 28 cows, 60 goats, 60 sheep and 14 camels).
- Blood smears were prepared and stained with Wrights-Giemsa stain.
- Slides were imaged using the Cellscope.
- Cellscope images were used to perform a CBC and differential by a veterinary student and by a veterinary clinical pathologist.
- CBCs were repeated using a traditional light microscope.

Imaging Method

- A minimum of 2 images of the feathered edge of the blood smear are taken to portray the subjective quality of the slide and to evaluate for platelet clumping, extracellular parasites and white blood cell distribution.
- 10 fields are imaged from the readable monolayer of the smear, chosen independent of cell populations.
- 100 white blood cells are then imaged to allow for a differential count.
- All images are compiled into a data set to be digitally sent and analyzed for a CBC with differential and evaluation of intracellular parasite.

Preliminary Results

- Duplicate blood smears from 60 goats, 60 sheep, 15 horses, 28 cattle and 14 camels have been prepared and stained.
- Preliminary data from 20 sheep suggest a wide variance in CBC differential.

Conclusions

- Cellular networks are available in remote areas of Mongolia and images of diagnostic blood smears can be taken on site and transmitted to experts for evaluation.
- The Cellscope allows for integrated imaging and image transmission.
- The Cellscope would make a valuable veterinary tool for in remote regions of Mongolia for both disease surveillance and veterinary care.
- Initial findings suggest improved direction for the imaging procedure may be needed to obtain comparable results between the Cellscope and traditional microscopy methods.
- There is a growing need for improving reach of veterinary care in rural Mongolia as more professionals move to urban centers.

References