Primer on EM Identification of Unknown Infectious Organisms

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Abstract

TEM is a valuable first line of investigation when organisms are suspected but unknown (e.g., SARS, polyomavirus, monkeypox). In these outbreaks, several weeks passed before the infectious agent was identified because "rapid" testing used reagents that did not "see" the agent. For molecular/immunological tests to work, one must "guess" what organisms might be present; the test answer is either "yes" or "no"; if it is "no", one can only say that the test did not find the organism suspected but does not suggest a pathogen. While less sensitive than molecular testing, especially if the infection is focal, TEM does not require an analyte-specific reagent. The key to discovery is a thorough knowledge of normal cellular fine structure to be able to recognize agents and pathologies that should not be present. Herein lies the caveat; many mistakes have been made describing agents, particularly viruses(1), when observers are not familiar with normal subcellular organelles. These include nuclear pores, clathrin-coated vesicles, caveolae, cross sections of distended endoplasmic reticulum, melanosomes, ribosomes, collagen, glycogen, and others. Clues for identifying infectious agents include size, cell wall type/thickness, presence of a nucleus/other organelles, replication method, and location within cells/tissues. Differentiation between organisms will be described.

References

1. Bullock HA, Goldsmith CS, Miller SE. Best Practices for Correctly Identifying Coronavirus by Transmission Electron Microscopy (Review).Kidney Int. 2021 Apr;99(4):824-827. doi: 10.1016/j.kint.2021.01.004. Epub 2021 Jan 22. PMID: 33493525 Free PMC article. Review.