

Low-Voltage Electron Microscopy for Nephropathology

The LVEM 25 from Delong Instruments presents a rapid, compact, and cost-effective alternative to traditional high-voltage TEM systems, increasing the accessibility of electron microscopy in clinical renal pathology.

Transmission electron microscopy (TEM) is vital for identifying pathological ultrastructural abnormalities, particularly within nephropathology. However, conventional TEM systems often pose barriers due to their high cost, demanding facility and maintenance needs, and complicated operations. The LVEM 25 low-voltage compact TEM addresses these issues as a lower-cost, easy to maintain, and user-friendly microscope without sacrificing image quality.

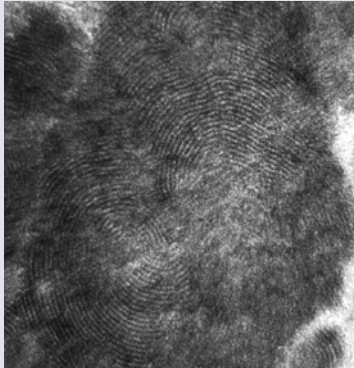


Fig A. *Lupus glomerulonephritis, presence of fingerprint-like deposits.*

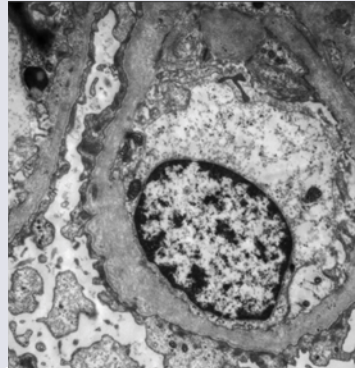


Fig B. *Alport syndrome, Glomerular basement membranes (GBM) show irregular thicknesses with a lamellated basket-weave.*

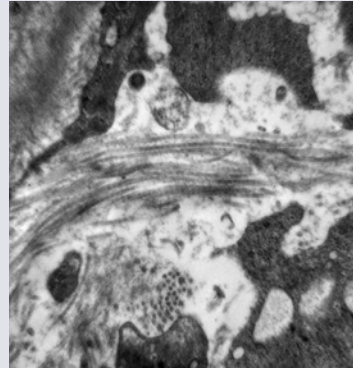


Fig C. *Collagen glomerulopathy, whorling appearance on low power and are abundant with cross-striated appearance on high power.*

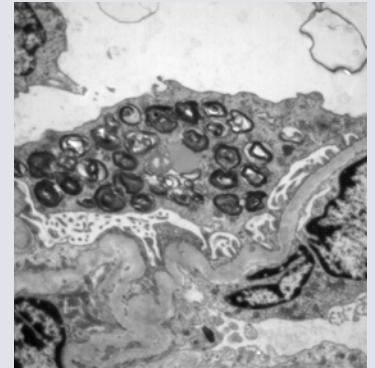


Fig D. *Fabry's disease, Presence of zebra bodies.*

In a clinical validation study by Lawrence et al. (2020), the low-voltage LVEM 25, operating in TEM mode at 25 kV, was compared to a high-voltage JEOL 1010 TEM, operating at 80 kV. This study included 90 consecutive biopsies from 10 pre-selected cases, focusing on known ultrastructural features of interest. Three participating pathologists independently captured and analyzed images from both systems in routine diagnostic workflows, focusing on microscopic disease presentation including immune deposits, glomerular basement membrane abnormalities, and podocyte injury.

The study demonstrated that the LVEM 25 offered diagnostic performance comparable to conventional TEM systems. The LVEM 25 provided sufficient resolution to detect critical ultrastructural features. Subsequent unpublished studies have shown the LVEM25 capabilities ability to accurately portray fingerprint (Fig A) and Tubuloreticular structures typical of Lupus nephritis, Collagen type III glomerulopathy (Fig C), Fibrillary glomerulopathy, Immunotactoid glomerulonephritis and Alport syndrome (Fig B) among others. The side-by-side comparison of images confirmed that the LVEM 25 delivers high-quality imaging, enabling accurate identification of key diagnostic markers. The LVEM 25 excels in delivering rapid, high-contrast, and high-resolution imaging essential for detecting subtle ultrastructural abnormalities, while being far more cost-effective and space-efficient than traditional systems.

Conclusion

Lawrence et al. (2020) concluded that the LVEM 25 is a clinically valid tool for ultrastructural evaluation, offering similar diagnostic capabilities as conventional TEM systems. Its compact design, lower operational complexity, and reduced costs make it especially suitable for pathology labs, where space and budgets are often limited. The LVEM 25 opens opportunities for labs to perform high-resolution ultrastructural analysis efficiently, ensuring timely diagnostics while maintaining a high standard of care. In busy pathology labs, where rapid diagnostics are essential, the LVEM 25 enhances throughput with its ease of use and fast sample exchange, reducing bottlenecks that are common with traditional, high-maintenance TEM equipment. This validation positions the LVEM 25 as a practical, reliable tool for routine clinical pathology applications.

Reference

Lawrence R, Isaac J, Lloyd I, Miller D. Clinical Validation of Low-Voltage “Compact” Transmission Electron Microscopy for Ultrastructural Evaluation of Kidney and Heart Biopsy Samples. *Laboratory Investigation*. 2020 Mar 1;100(Suppl 1):1701-1702.

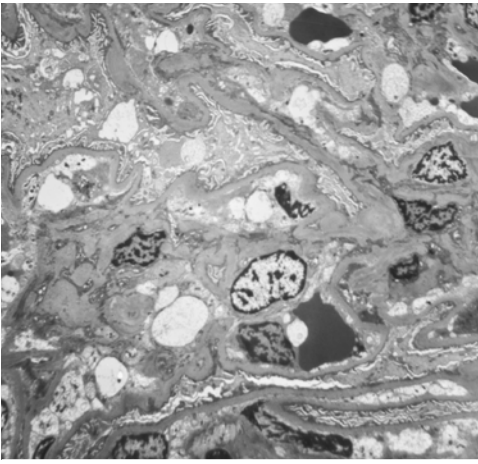


Fig E. Overview of kidney ultrastructure, Low magnification.

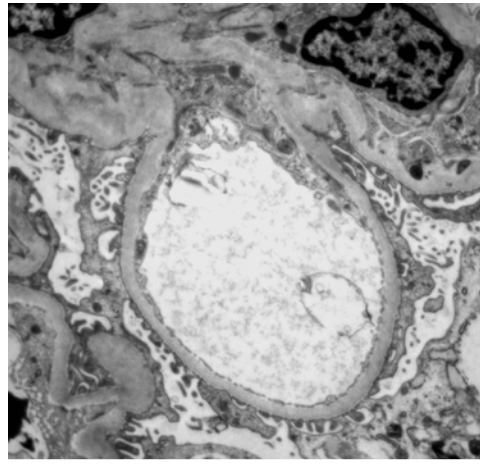


Fig F. Whole glomerulus in view, Mid magnification.

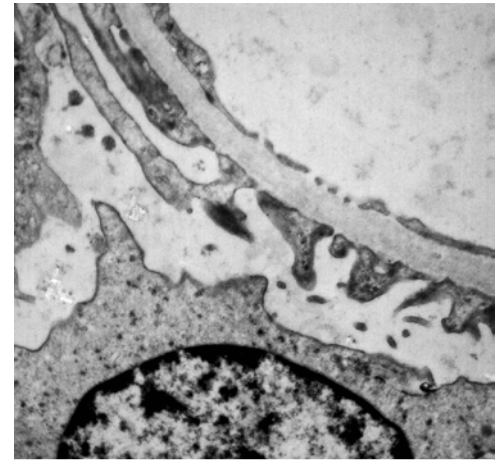


Fig G. Podocyte effacement slit pores easily seen, High magnification.

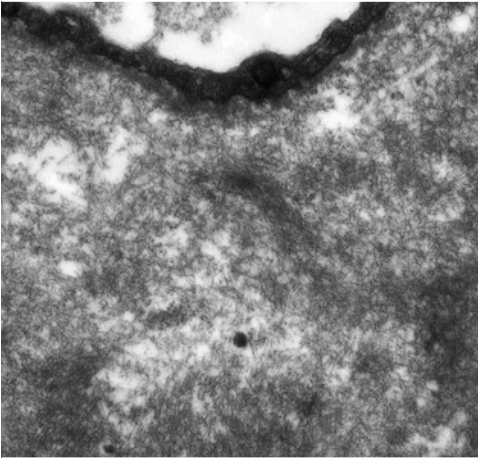


Fig H. Amyloidosis, Amyloid fibers visible at high magnification.

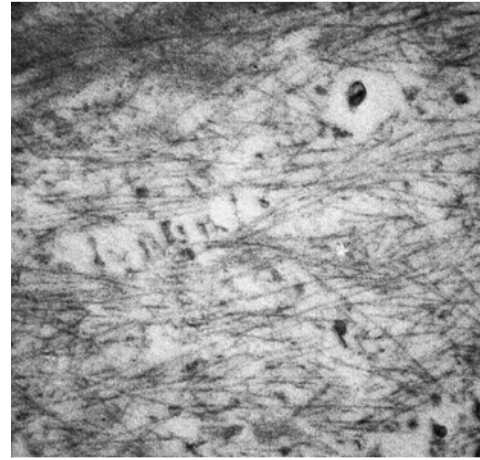


Fig H. Amyloidosis, Amyloid fibers visible at high magnification.

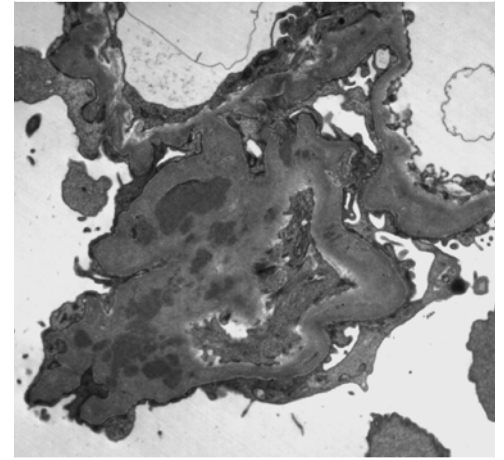


Fig J. Dense deposit disease, Dense deposits seen in GBM.

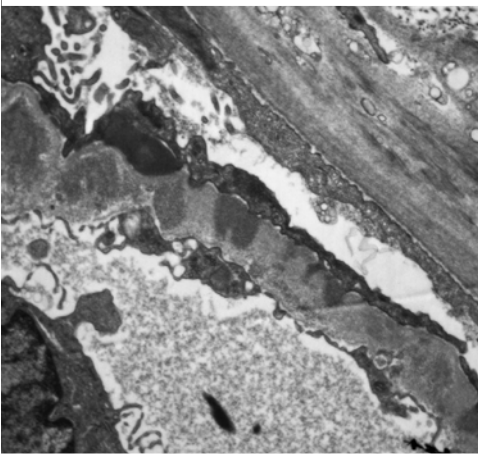


Fig K. Lupus Nephritis, Subepithelial deposits in basement membrane.

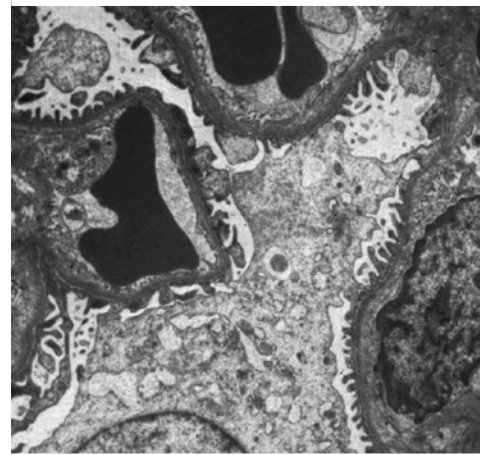


Fig L. Foot process and filtration barrier changes.

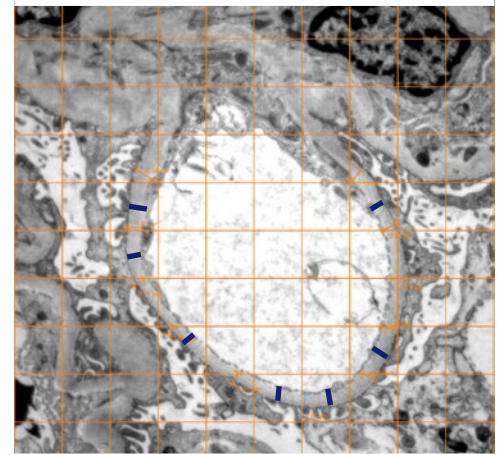


Fig M. Measuring basement membrane thickness in real time on live image.

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