# CLINICAL VALIDATION OF LOW-VOLTAGE “COMPACT” TRANSMISSION ELECTRON MICROSCOPY FOR ULTRASTRUCTURAL EVALUATION OF KIDNEY AND HEART BIOPSY SAMPLES

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## Background:

- Transmission electron microscope (TEM) remains an integral part of the pathologic evaluation of various specimen types, especially renal and cardiac biopsies
- Conventional TEM instruments are costly, occupy a substantial floor space footprint, and have significant overhead costs
- A new “compact” TEM instrument is now available, which circumvents some of the drawbacks posed by conventional TEM
- We report the results of a clinical validation exercise, comparing the diagnostic utility of images obtained on a conventional TEM and compact TEM

## Design:

- 90 consecutive clinical biopsies and 10 pre-selected biopsies (known to have certain ultrastructural features of interest) were selected for a parallel testing validation strategy
- These included 85 native kidney, 5 transplant kidney, and 10 heart biopsies; from 98 patients
- Samples were prepared for TEM per routine protocols
- Samples were examined using a JEOL 1010 TEM at 80 kEV using a Veleta side-mount 4MP camera and a Delong Instruments LVEM25 TEM at 25 kEV using its integrated 5.5MP camera
- Three pathologists captured images (in the course of their routine diagnostic work) which were later retrospectively compiled, reviewed, and compared for salient ultrastructural features [Tables 1 & 2]

**TABLE 1: Frequency of Findings**

| *Microscopic Disease Process* | *n=* |
|---|---|
| Mesangial Immune Deposits | 26 |
| Subepithelial Immune Deposits | 13 |
| Subendothelial Immune Deposits | 9 |
| Tubuloreticular Inclusions | 1 |
| Thickened Glomerular Basement Membranes | 16 |
| Thin Glomerular Basement Membranes | 3 |
| Podocyte Foot Process Effacement | 15 |
| Fibrillary Deposits | 4 |
| Organized Substructure | 2 |

## Results:

- Minor qualitative differences in the images were observed between the two TEM instruments, but these did not substantially alter the diagnostic interpretability
- Representative comparisons of ultrastructural findings with each instrument are shown to the right [FIGURES]

## Conclusions:

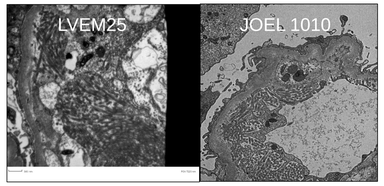
- Compact TEM is a clinically valid means of ultrastructural evaluation of renal and cardiac biopsy specimens
- Compact TEM maintains comparable ability to discriminate key diagnostic findings in these samples

**TABLE 2: Cases by Disease Process**

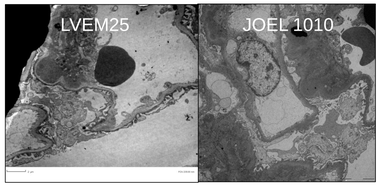
| *Diagnosis* | *n=* |
|---|---|
| AIN | 8 |
| Amyloid | 4 |
| ANCA GN | 4 |
| ATN | 5 |
| Cast Nephropathy | 1 |
| Chloroquine cardiotoxicity | 1 |
| Chronic TMA | 1 |
| Cortical necrosis | 1 |
| Diabetes | 14 |
| DM + immune complex | 1 |
| FSGS | 9 |
| HTN | 7 |
| IDCM | 2 |
| Idiopathic nodular sclerosis | 1 |
| IgA | 9 |
| IgA + Diabetes | 1 |
| IgG-K MPGN w crescents (same pt) | 2 |
| Immune complex GN in transplant | 1 |
| Immunotactoid (same pt) | 2 |
| Lupus | 9 |
| Membranous | 1 |
| Minimal change disease | 4 |
| Minimal change + IgA | 1 |
| Myocarditis | 2 |
| Negative heart biopsy | 3 |
| Postinfectious GN | 2 |
| Recurrent IgA in transplant | 1 |
| Thin GBM | 2 |
| Transplant TCMR | 1 |

## Figures : Representative Comparative Case Images

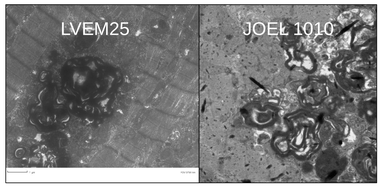
*Immunotactoid*



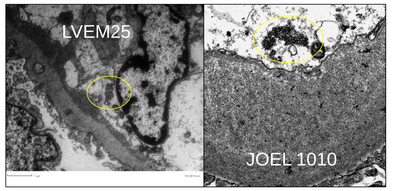

*IgA Nephropathy*



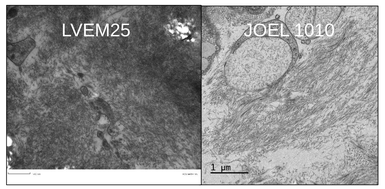

*Hydroxychloroquine toxicity*



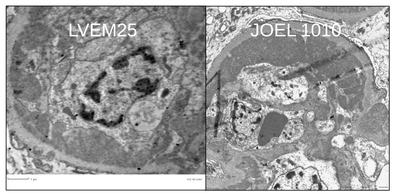

*Tubuloreticular Inclusions (Lupus)*



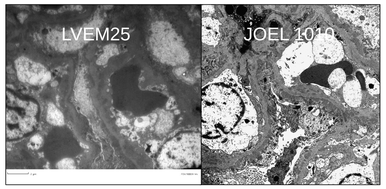

*Amyloid*



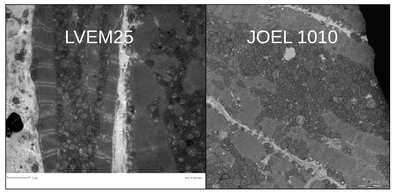

*Subendothelial Deposits*




*Subepithelial Deposits*




*Normal Myocardium*

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