Detecting hypertensive vascular features in retina images in preeclampsia

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Purpose
Preeclampsia, a hypertensive disorder of pregnancy, remains a leading cause of maternal morbidity and mortality. Maternal hypertensive manifestations can affect multiple organs, including the eyes. Our purpose was to evaluate hypertensive microvascular features in ultra-widefield retinal imaging and determine if such features could distinguish between women with preeclampsia and healthy pregnant women.

Methods
This case-control study (#2021H0183) enrolled women with severe preeclampsia between 24 and 34 weeks of pregnancy and gestationally matched healthy pregnant women as controls. Subjects did not have preexisting hypertension, diabetes, or retinal disease. Fundus imaging was performed bilaterally using the Optos® ultra-widefield camera. Graders assessed masked images for the presence or absence of hypertensive retinal vascular features: arteriovenous nicking (AVN), focal arteriolar narrowing (FAN), microaneurysms, blot hemorrhages, flame hemorrhages, hard exudates, cotton wool spots, copper wiring, silver wiring, vessel tortuosity, and disc edema. Diagnostic performance statistics (accuracy, sensitivity, and specificity) for these binary traits were calculated from cases and controls.

Results
Preliminary data from 13 cases (27.8±6.7 years; 2 Black, 11 White) and 9 controls (27.8±6.5 years; 2 Black, 6 White, 1 Native Hawaiian) were evaluated with 70 fundus images. There was no significant

difference in BMI between the cases and controls (37.9±7.6kg/m2 vs 33.5±7.7kg/m2, p=0.34). Among graded hypertensive vascular features, FAN in the temporal and nasal superior regions showed the highest accuracy (69%) in distinguishing cases from controls (see Table). Additionally, FAN in the nasal superior region had the highest specificity of 98%. Features with an accuracy of over 60% had a sensitivity of over 70%, including FAN, AVN, and copper wiring. Flame hemorrhage, hard exudate, cotton wool spot, silver wiring, and disc edema had specificities of 100%.

Conclusions

Ultra-widefield retinal imaging can non-invasively detect hypertensive microvascular features in severe preeclampsia. Hypertensive microvascular features show promise as potential markers of cases with preeclampsia compared to healthy pregnant controls, with some features and regions of the retina being more indicative.