Multi-institutional collaborative research using ophthalmic medical image data standardized by Radiology Common Data Model (R-CDM)

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Background

- **Unstructured data** which is beyond the scope of OMOP-CDM standardization is difficult to be used for multi-institutional collaborative research.

- **Radiology Common Data Model (R-CDM)** has been developed to standardize the terminology and structure of medical image data.
Optical coherence tomography (OCT) calculates various features about **retinal thickness** by scanning internal structure of the eyeball.

By using OCT data, studies showed significant relationship between age, hypertension, type 2 diabetes, vitamin D deficiency, and retinal thickness.

- All of the studies analyzed a small number of patients in a single medical institution due to the **data acquisition issues**.

In this study, a **multi-institutional collaborative research** was conducted by standardizing OCT data into a format of R-CDM.
Methods

Data Acquisition

- OCT data was collected from Ajou University School of Medicine (AUSOM) and Seoul National University Bundang Hospital (SUNBH), tertiary hospitals in Korea
  - OCT from AUSOM was taken with ZEISS medical device from Jan 2013 to Apr 2022
  - OCT from SNUBH was taken with HEIDELBERG medical device from Jul 2006 to Aug 2019

Data Standardization

- OCT data collected from both hospitals were standardized in the form of R-CDM

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Study design to analyze changes in retinal thickness due to chronic disease

**HTN cohort**
- HTN medication intake (index date)
  + Diagnosis of HTN
- Taking HTN medication for more than 10 years
  + Exits cohort if patient has stopped taking HTN drug for more than 180 days
- No DM, retinal disease

**Comparator cohort (normal)**
- All time normal blood pressure
- No DM, HTN, retinal disease
OCT data extraction through interworking of R-CDM and OMOP-CDM

Methods

OMOP-CDM

- Person
  - Personal ID, Sex, Birth, Race

OMOP-CDM

- Condition Occurrence
  - Condition, Start/end date, Type, Stop reason

OMOP-CDM

- Procedure Occurrence
  - Procedure, Date, Type

OMOP-CDM

- Radiology Occurrence
  - Occurrence date/time, Protocol concept ID, Total image count

OMOP-CDM

- Radiology Image
  - Image resolution, Contrast administration status, Image photographing direction

Radiology-CDM

HTN, DM, and control cohorts were constructed through OMOP-CDM. OCT data taken by each cohort were extracted through R-CDM.
Methods

Retinal thickness data extraction using OCR technique
Results

Composition of R-CDM standardized OCT data

**Ajou University School of Medicine**
- (261,874 images)
  - TD-OCT (35,406 sheets)
  - HDI (28,300 sheets)
  - GPA (58,605 sheets)
  - RNFL thickness (33,329 sheets)
  - GCIPL thickness (33,189 sheets)
  - Macular thickness (72,971 sheets)

**Seoul National University Bundang Hospital**
- (475,626 images)
  - Macular thickness (219,996 sheets)
  - Others (147,644 sheets)
  - RNFL thickness (107,986 sheets)

46.3%
Analysis of retinal thickness differences between cohorts

- RNFL thickness, and Central macular thickness from **HTN cohort was significantly lower** than that of the normal control cohort.
Conclusion

- In this study, OCT data of AUSOM and SNUBH were obtained for research purposes and standardized in the form of R-CDM.

- The retinal thickness was compared between the patients with chronic disease and the normal:
  - Retinal thickness was significantly lower in the patients with hypertension for more than 10 years.

- It is meaningful in that multi-institutional collaborative research which combines clinical and image data in various ways can be conducted very efficiently.
Thank you

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