Abstract Submission No. : 9075
May 26(Thu), 13:30-15:30 Big Data

Mendelian randomization study: an analytic tool to investigate causal effects with observational data

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Identifying causal effects in clinical medicine is an important topic, as a causal pathway can suggest pathophysiologic mechanisms, preventive measures, and therapeutic targets. However, there are certain limitations to investigate causal effects by conventional observational studies (e.g. confounding effects) or by clinical trials (e.g. cost or difficulty in exposure control).

Mendelian randomization is an analytic method that can identify causal estimates with epidemiologic data. Mendelian randomization utilizes a genetic instrument that is fixed before birth; thus, instrumented genetic predisposition is minimally affected by confounders or reverse causation. The significant association between genetic predisposition, which would result in a higher occurrence of the exposure of interest, and the outcome would suggest the presence of a causal effect of the exposure. MR has been widely introduced in the medical literature and has identified an important causal linkage between complex exposures and outcomes. In the nephrology field, Mendelian randomization has been used to study causal effects from kidney function and the risk factors affecting the risk of chronic kidney disease.

In this lecture, the concept of Mendelian randomization analysis will be introduced, along with the published studies particularly in the nephrology field. Understanding the power and limitations of this recently popularized analytic tool will be important in the future medicine, as appropriate interpretation of the findings from Mendelian randomization study can expand medical knowledge and improve clinical practice.