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Professor Yong Gu Lee's research team develops a stent structure that facilitates insertion of irregular shaped blood vessels by using a 3D printer

□ GIST (President Seung Hyeon Moon) – Yong Gu Lee of the School of Mechanical Engineering led a research team that successfully solved the insertion problem of existing branch-type stents by using kirigami * structure and shape memory polymer.

* Kirigami is a variation of origami that includes cutting rather than solely folding, as is the case with origami.

◦ A branch-type stent made of a shape memory alloy wire, such as a conventional Nitinol, * has protruding parts when inserted into the blood vessel. Therefore, the research team solved this problem by creating a branch-type stent that can be expanded manually through a specific external stimulus.

* Nitinol is a metal alloy of nickel and titanium and exhibits two closely related and unique properties: shape memory effect and super-elasticity.

□ The kirigami structure used in the study is applied to various engineering fields as it features the ability to express three-dimensional images from a plane. By applying this kirigami structure, the research team was able to design stents that were initially easy to

insert into the blood vessels then split into each blood vessel by expanding and deforming over time.

- In addition, filaments for 3D printers manufactured with shape-memory molecules and FDM-style 3D printers* were used to allow variations in geometry by temperature.

  * Fused deposition modeling (FDM) uses a continuous filament of a thermoplastic material.

- As a result, the 3D printed branch-type stent was modified before intravascular insertion, inserted into a suitable location, and then expanded vessel branches through temperature changes.

□ Professor Yong Gu Lee said, "The results of this study showed that the use of a 3D printer could produce a stent suitable for irregularly shaped blood vessels and solved the existing bifurcated stent insertion and definition problems. Future studies are expected to be applicable to real surgery if biocompatible materials are applied."

□ This study was carried out with the support of IITP and GRI (GIST) with Tae-young Kim as first author and Professor Yong Gu Lee as correspondent author and published in *Scientific Reports* on September 17, 2018.