Automated MRI method to visualize blood flow in the heart

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Video Abstract

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Abstract

Ischemic heart disease is a narrowing of the arteries that supply blood and oxygen to the heart. Caused by a build-up of plaque, this restricted blood flow, or ischemia, can cause chest pain and heart attacks, and is among the leading causes of death worldwide. Increasingly, physicians are looking to use MRI to visualize and measure the extent and severity of ischemia. This technique involves the injection of a contrast agent into a blood vessel in the arm. MRI is then used to create a series of images of the heart as the agent is delivered to the muscle, allowing physicians to visualize regions receiving inadequate blood flow. Images are acquired both at rest and during the “stress” induced by giving the patient a drug that increases blood flow to the heart as would occur during exercise. The utility of this approach, however, has been hindered by a lack of objective evaluation methods and the time-consuming task of processing the results in a laboratory setting. With this in mind, a team of researchers working in the US and Sweden set out to develop a method to both measure and visualize blood flow to the heart, in a way that optimizes the imaging protocol, and integrates this into a fully automated clinical workflow. [CLIP B revised: “By providing a single map that is color coded to differentiate ischemic from normal tissue the need to examine hundreds of raw images is eliminated making it simpler and faster to analyze the data.”] To accomplish this, the team built on past MRI research and attempted to characterize and remedy inaccuracies in quantification caused by a non-linear relationship between contrast agent concentration and signal intensity. They then created an automated workflow in which numerous correction and normalization steps are carried out on images obtained from MRI scans. This newly developed tool allows for the mapping of blood flow under rest and stress conditions. The image processing is completely automatic, and the resulting images are available to the physician in a matter of minutes rather than hours or days, as has previously been the case. Dr. Kellman further discusses the utility of this new quantification method. This ability provides clinicians with a more objective assessment strategy and promises to make MRI a viable option to quickly — and accurately — visualize ischemia and, therefore, greatly enhance patient care.