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Mitral Regurgitation And Atrial Fibrillation: An Explorative Fluid-Structure Interaction Study

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Extended Abstract

Atrial fibrillation (AF) is a common cardiac arrhythmia which promotes blood stagnation into the left atrial appendage (LAA), a muscular sac attached to the left atrium of the heart. This stasis increases the risk of blood clot formation and ischaemic complications [1]. This pathology strongly increases with age, affecting about 8% of octogenarians. This implies that it is often concomitant with other common age elated cardiac pathologies such as mitral regurgitation (MR), a condition where the mitral valve does not close properly, allowing blood to flow back from the left ventricle into the left atrium.

Some clinical studies have explored the association between AF and MR, suggesting that MR might have some protective effect, reducing the probability of clot formation [2-4].

This study aims to investigates how the interaction between AF and MR may alter the haemodynamics into the LAA, to identify the biomechanics of the phenomenon [5]. To this end, computational approaches are adopted, which have already demonstrated their efficacy in investigating the complex relationship between the LAA anatomy and operative function and the risk of thromboembolism in AF patients [6-9]. These computational tools, mentioned above, have demonstrated significant effectiveness in elucidating the underlying mechanisms of thromboembolic risk in patients with AF.

In particular, a fluid-structure interaction approach is used to simulate blood flow in the LAA under three different conditions: healthy, AF and MR. Results indicate that MR has a significant impact on the motility of LAA, improve the wash out and reduce stagnation. Moreover, the blood stasis factor (BSF), a factor recently identified to quantify the risk of clot formation in LAA, reduces of two folds [9]. This supports the protective effect of MR observed clinically, clarifying the mechanism.

These findings suggest that both LAA features and MR should be taken into consideration when assessing the thromboembolic risk in patients with AF. A combined approach, both numerical and clinical, could potentially improve patient management strategies and lead to a reduction in stroke events.

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