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COMPUTATIONAL METHODS FOR ARTIFICAL ORGAN DEVELOPMENT

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ABSTRACT

Cardiovascular diseases are among the main causes of death worldwide, with growing patient numbers [1]. In many patients, traditional treatment with pharmaceuticals is not enough to ensure an acceptable quality of life or even survival. Especially in very sick patients, artificial organs and cardiac assist devices are considered a valid treatment option. In some critical cases, they are even last chance for survival. With an ageing population and an ongoing shortage in donor organs, their demand is expected to rise further in years to come [2].

However, the advanced engineering concepts and hemodynamic requirements of medical devices demand new tools to support the development process, which should be combined with established methods to ensure both efficacy and safety.

Computational approaches may help to save development time and costs, as well as to support the development process by identifying crucial interactions and by understanding underlying mechanisms that evade experimental or clinical testing alone. It is therefore imperative to include computational modelling in the development of artificial organs.

This Minisymposium aims to foster a detailed discussion on the use of computational methods during artificial organ development as well as experimental and clinical validation thereof. Applications of computational mechanics, computational fluid dynamics, coupling mechanisms and further modelling techniques are discussed in the framework of artificial heart valves, stents, blood pumps, oxygenators, dialyzers and other artificial organs. The goal is to optimize designs with respect to efficiency, durability and hemodynamic requirements.

Besides computational modelling linked directly to artificial organs themselves, special focus lies on the interaction of these devices with the human body. This will address how numerical models may be used to predict later clinical complications and adverse events at early stages of the development process and thereby help to reduce the probability for such events prior to clinical trials, by understanding hemolysis and thrombogenicity as well as the impact of different models of human blood.

In addition, examples and methods for experimental and clinical validation of computational modelling will be presented with the objective to support credibility and acceptance of these novel approaches in the field of artificial organs.

Lastly, lively discussions between researchers from different fields are expected in order to promote and support further progresses and ideas for applications of computational methods for artificial organ development.

REFERENCES

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