Numerical Simulations of Heat and Evaporation Losses from Preterm Infant inside an Incubator under Different Conditions

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ABSTRACT

In 2010, 11.1% of babies were born premature [1]. These babies face difficulties keeping a controlled body temperature without external assistance. Consequently, they can suffer from cold stress and hypothermia [2]. Therefore, it is crucial to maintain an optimal thermal and humidity environment of the neonate by using incubators.

The design of efficient incubators is important for the neonate survival and growth. Many methods could be used to design and optimize incubators. Numerical simulation, namely CFD (computational fluid dynamics), is a very useful tool since it does not necessitate expensive experimental work and it can assess locally the incubator environment such as the velocity, temperature and humidity distribution.

The objective of the present work is to analyse the heat and mass transfer processes between a preterm infant nursed in an incubator under different operating conditions. This is achieved by using finite volume method to discretize the Navier-Stokes, energy and mass transfer equations.

Conduction, convection and radiation heat transfer modes are modelled in the simulations and coupled to a bioheat model for neonates.

The different incubator scenarios considered here are compared in terms of dry and latent heat losses to access the hygrothermal comfort for neonates.

REFERENCES

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