# SIMULATION OF DECOMPRESSIVE CRANIECTOMY FOR ISCHAEMIC STROKE TREATMENT : A COMPUTATIONAL STUDY

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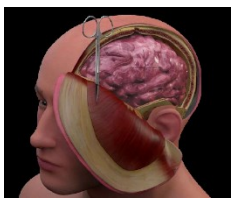
## RESEARCH BACKGROUND

Part of the skull removed surgically

To reduce intracranial pressure (ICP)



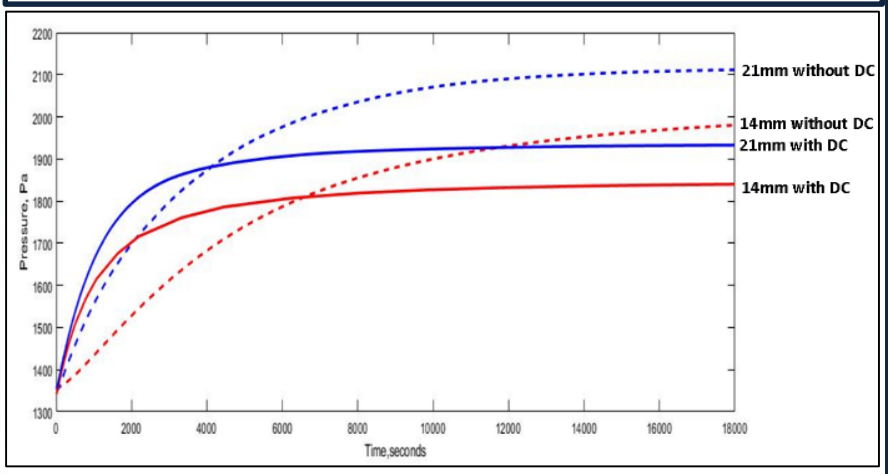
Objectives : To evaluate the effectiveness of DC in treating brain tissue swelling using computational study based on capillary filtration and poroelastic theory

To provide an additional prediction

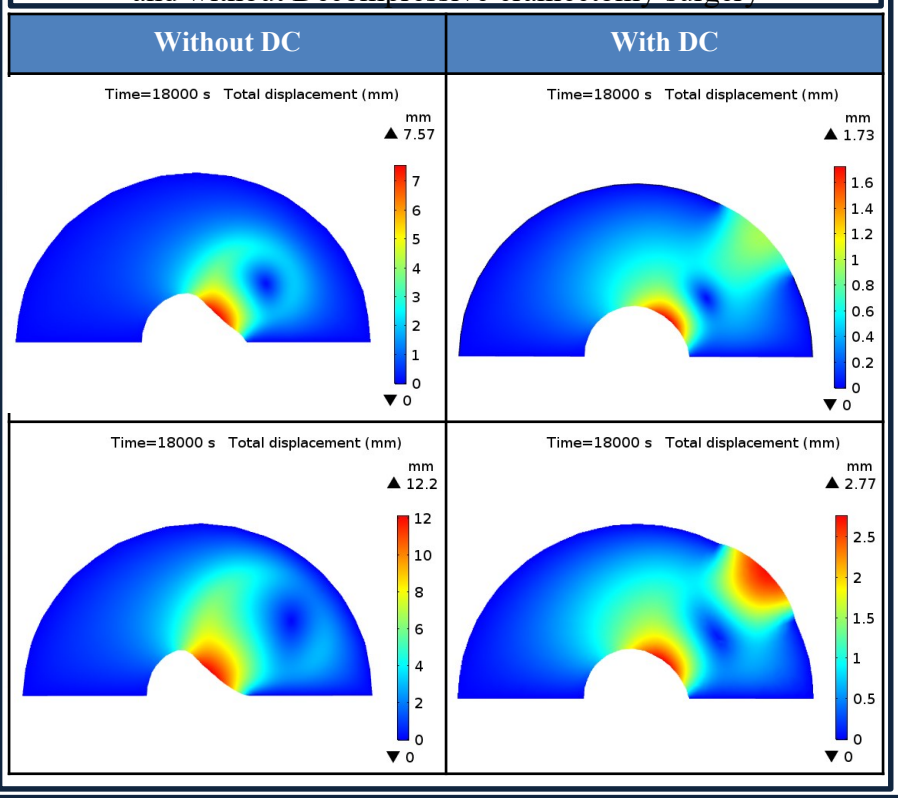
Give some insights to neurosurgeon before performing surgery

## RESULTS

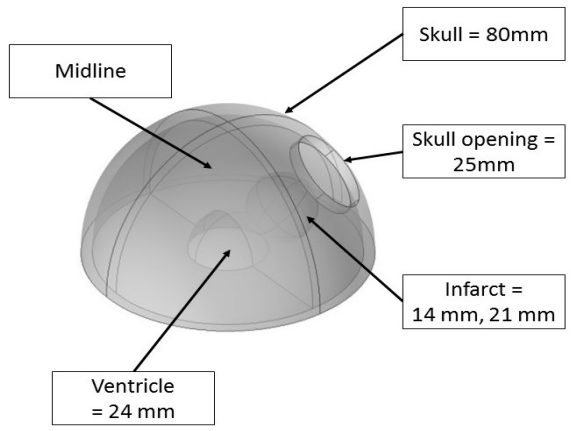
Maximum pressure for infarct sizes = 14mm,21mm against Time




Maximum displacement for infarct sizes = 14mm,21mm with and without Decompressive craniectomy surgery




## METHODOLOGY




**Mathematical modelling**

$$\nabla . \sigma_{ij} - \alpha_w \nabla P_w = 0 \qquad (1)$$

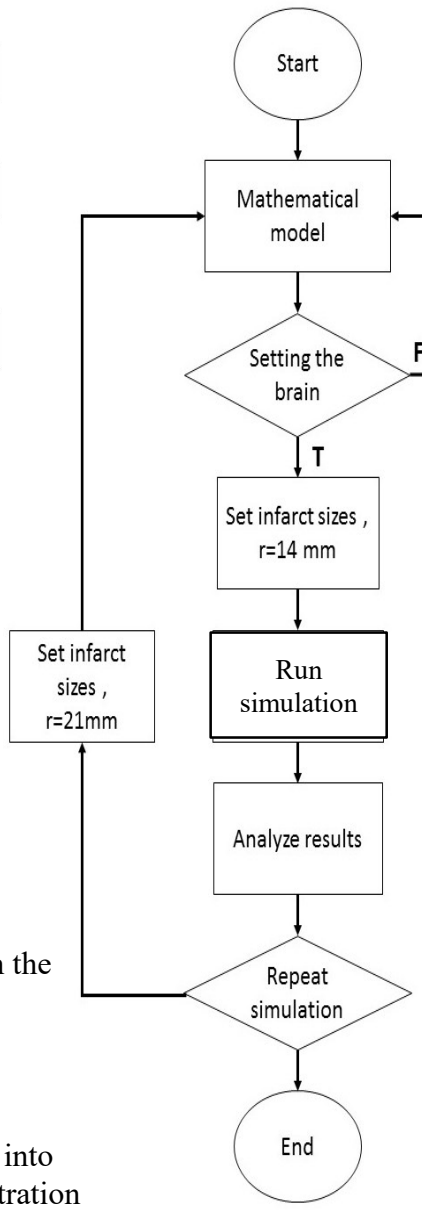
- relationship between brain tissue stress and intracranial pressure, where:

$\sigma_{ij}$ = total of tissue stress,
$P_w$ = interstitial water pressure
$\alpha_w$ = water Biot parameter

$$\frac{1}{Q_w}\frac{\partial P_w}{\partial t} - k_w \nabla^2 P_w - S_{b \to w} \qquad (2)$$

- interstitial water pressure distribution in the brain, where:

$Q_w$ = relative water compressibility
$k_w$ = water permeability
$t$ = time
$S_{b \to w}$ = water transfer from capillary space into cerebral interstitial space due to capillary filtration




## CONCLUSION

- Development of computational studies nowadays being very useful as an additional information in clinical research before performing the surgery.

## NOVELTY

- New standardized framework in healthcare based learning by using latest advancement of technology

## BENEFITS

- Decreased error before surgery
- Save time required for surgery (surgery run smoothly)
- Enhance the surgery outcome

## MARKETABILITY & COMMERCIALISATION

- Potential user


Hospital (provide treatment for brain swelling)

## ACKNOWLEDGEMENT

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## COLLABORATION

## Publication

- M. J. Mohamed Mokhtarudin and S. J. Payne, "Mathematical model of the effect of ischemia-reperfusion on brain capillary collapse and tissue swelling," *Math. Biosci.*, vol. 263, pp. 111–120, 2015.
- Nadzri, A. N., Mokhtarudin, M. J., Naim, W. N. & Payne, S. J. "Simulation of Decompressive Craniectomy for Ischaemic Stroke Treament : A Conceptual Modeling Study". **15**, 2021. (will be publish soon)