

## **Effect of anastomosis angle on hemodynamic of side-to-end radiocephalic arteriovenous fistula (RCAVF)**

*Wan Anuar Wan Hassan<sup>a</sup>; Kahar Osman<sup>b</sup>; Mohammed Rafiq Abdul Kadir<sup>c</sup>; Wan Ahmad Kamil Wan Abdullah<sup>d</sup> and Juhara Haron<sup>d</sup>; Mohd Zamani Ngali<sup>e</sup>*

<sup>a</sup>Faculty of Mechanical Engineering Universiti Malaysia Pahang, 26600 Pekan, Pahang, Malaysia

<sup>b</sup>Faculty of Mechanical Engineering Universiti Teknologi Malaysia, 81300 Skudai, Johor, Malaysia

<sup>c</sup>Faculty of Biomedical Engineering & Health Science Universiti Teknologi Malaysia, 81300 Skudai, Johor, Malaysia

<sup>d</sup>Department of Radiology Hospital Universiti Sains Malaysia, Kubang Kerian, Kota Bharu, Kelantan, Malaysia

<sup>e</sup>Faculty of Mechanical and Manufacturing Engineering Universiti Tun Hussien Onn Malaysia, 86400 Parit Raja, Batu Pahat, Johor, Malaysia

### **ABSTRACT**

Radiocephalic arteriovenous fistula (RCAVF) at wrist is the chosen access for hemodialysis. Most studies describe access complications without considering the effect of the anastomosis angle. In the present investigation, eighteen three-dimensional, simplified models of RCAVF were used to analyze the hemodynamic effect of anastomosis angle under fixed flow rate of 900 ml/min, corresponding to Reynolds number 950. EFD. Lab software was used in the flow simulation with steady flow conditions. The results show that high pressure drop was observed for RCAVF with smaller anastomosis angle. However, for cases with anastomosis angle larger than 45°, pressure drop became relatively constant. The results also show that large vortices appeared in cases with angle smaller than 30°. For cases with angle larger than 60°, low flow zone appeared at the inner wall that may lead to promotion of intimal thickening and formation of stenosis. Overall, for average flowrate, it is recommended that anastomosis angle should be maintained between 45° and 60° to minimize adverse effects.

### **KEYWORDS:**

anastomosis angle; Radiocephalic arteriovenous fistula (RCAVF); simplified model

## REFERENCES

1. Sivanesan, S., How, T.V., Bakran, A. Sites of stenosis in AV fistulae for haemodialysis access. (1999) *Nephrology Dialysis Transplantation*, 14 (1), pp. 118-120.
2. Van Canneyt, K., Pourchez, T., Eloit, S., Guillame, C., Bonnet, A., Segers, P., Verdonck, P. Hemodynamic impact of anastomosis size and angle in side-to-end arteriovenous fistulae: A computer analysis (2010) *Journal of Vascular Access*, 11 (1), pp. 52-58.
3. Sivanesan, S., How, T.V., Bakran, A. Characterizing flow distributions in AV fistulae for haemodialysis access (Open Access) (1998) *Nephrology Dialysis Transplantation*, 13 (12), pp. 3108-3110
4. Kumar, A., Jha, M.S., Singla, M., Gupta, N., Raina, P., Dubey, D., Srivastava, A. Radio-median cubital / radiocephalic arteriovenous fistula at elbow to preventm vascular steal syndrome associated with brachiocephalic fistula: Review of 320 cases.
5. Bessa, K.L., Ortiz, J.P. Flow visualization in arteriovenous fistula and aneurysm using computational fluid dynamics (2009) *Journal of Visualization*, 12 (2), pp. 95-107.