

Kiyoshi Ikeda, Toru Yasuda

Ikeda Vascular Access Dialysis and Internal Medicine Clinic

Background

During dialysis, if blood flow rate increases above 1500ml/min. there is an increase in pulsation and a high possibility of heart failure. In the long run, it can cause valvular disease and arrhythmia. In EDTA 2015, we presented a method of blood flow suppression for dialysis patients who had heart failure caused by excessive blood flow. However, within one year, 30% of the cases had relapsed. To solve this problem, we were able to prevent the recurrence of excess blood flow through improvement measures with a new device. Report including theoretical mechanisms.

Aim

During vascular access excessive shunt blood flow creates a heavy load on cardiac function. Performing blood flow control surgery on dialysis patients with heart failure symptoms improves said function. Depending on the surgical method, it may recur. For this reason, we devised a surgical method that theoretically considers recurrence suppression.

Subject & Methods

Clinical symptoms before surgery were based on trial hemodialysis patients with significant arrhythmia and shortness of breath at the time of exertion (6 males 4 females) using EPTFE of 4mm in diameter and 4cm in length or more replaced veins extended from anastomosis. (As shown in Poiseuille's law, it is necessary to replace veins with a shunt of smaller diameter but longer length than the vein being replaced.) The point of insertion at the anastomosis portion of the artery is 4mm. In order to connect to the larger section of the vein to the other end, it is cut diagonally to make the connection secure. During the operation, blood flow was monitored using ultrasound. The central side of the tibia artery was also tied off in some cases to control blood flow.

Poiseuille's law

$$Q = \frac{\pi a^4 \Delta p}{8 \mu L}$$

Q: flow(m³/s)
a: radius(m)
Δp: fluid density(kg/m³)
μ : viscosity coefficient(Pa · s)
L: length(m)

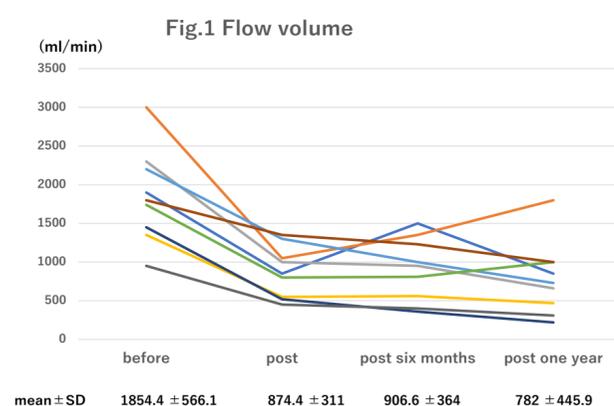
From Poiseuille's Law we know blood flow rate increases with pressure and decreases with longer vessel length.



Blood flow was controlled by placing an e-PTFE graft with a diameter of 4 mm for 5 cm. The blood flow in the image could be suppressed from 1740 ml / min to 850 ml / min.

Results

Blood flow was reduced to 874 ml/min immediately after surgery from 1854ml/min before surgery, 906ml after 6 months, and 782 ml/min after one year. Symptoms of arrhythmia disappeared in two patients during surgery and in all cases shortness of breath during exertion disappeared the day after surgery. Cardiac index improved three months after surgery in three cases. In none of the cases did we observe the complete rekindling of blood flow after one year. The average blood flow was less than 58% of the rate before surgery.



Consideration

In the 2015 report, banding by graft caused problems such as increased blood flow and blockage due to displacement of the banding site. However, in this substitution, only curving of the graft has occurred. Blood flow suppression by graft substitution from the anastomosis portion was made possible by the development of a 4mm diameter graft. Vascular access procedure was made easier with the new design except for the connection to the larger vein where we used the diagonal cut.

Conclusion

Replacement of 4cm or more length sections of veins with a 4mm diameter graft was useful in improving cardiac function in dialysis patients with heart failure.

COI Disclosure

This presentation is not related to any company with a conflict of interest that should be disclosed