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Original Article

Results of Autogenous Arteriovenous Fistula Performed by General Surgeon at Secondary-level Hospital

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Background and Objective: To determine the results of autogenous arteriovenous fistula (AVF) performed by a general surgeon at secondary-level hospital, in terms of maturation rate, primary patency rate, and complication rate.

Material and Methods: Between October 2011 and November 2014, 64 patients with indications for hemodialysis (HD) were considered for permanent venous access at Phetchabun Hospital. Fifty AVFs were performed on 47 patients who had been selected on physical examination to have adequate vessels. Patients were followed until June 2015.

Results: Of 64 patients, 47 patients (73%) underwent 50 AVFs which composed of 3 radiocephalic AVF (6%), 46 brachiocephalic AVF (92%) and 1 brachiobasilic AVF (2%). Overall maturation rate was 90%. Mean time of maturation was 8.6 weeks. Primary patency rate was analyzed by descriptive survival analysis. Primary patency rate of AVF at 6th month, 1st, 2nd and 3rd year was 89%, 87%, 82% and 82%, respectively. Post-operative hematoma was the only complication seen (8%).

Conclusion: General surgeons in the setting of secondary-level hospital can perform AVF effectively in selected patients, selecting appropriate types of AVF, with proper time of initiation hemodialysis.

Keywords: Autogenous arteriovenous fistula, maturation rate, primary patency rate, complication rate, ESRD, general surgeon, secondary-level hospital

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INTRODUCTION

At present, the incidence of end-stage renal disease (ESRD) is increasing^{1,2}. Choices of renal replacement therapy (RRT) include peritoneal dialysis, hemodialysis (HD) and renal transplantation³. HD can effectively prolong life and this has led to an increased demand for HD. For example, data from the Thai Renal Replacement Therapy Registry in 2010 showed a prevalence of patients needing HD of 30,835 cases or 482.2 cases per million, with an incidence of 6,244 cases or 97.7 cases per million per year⁴, thus causing an increase in the number of procedures for permanent vascular access at the same time.

The Kidney Disease Outcomes Quality Initiative (KDOQI) advocated Fistula First Program since it is well-established that arteriovenous fistula (AVF) has superior long-term function^{5,6}, lower health care cost⁷, fewer infectious and ischemic complications^{8,9} compared to other means of vascular access. Currently, vascular surgeons are not readily available in most provinces of Thailand, and therefore general surgeons must assume that role in the service of these ESRD patients in many provincial hospitals (secondary-level hospitals). The aim of the present study was to review the results of the author's experience, as a general surgeon, in performing AVF at a secondary-level hospital.

MATERIAL AND METHODS

From October 2011 to November 2014, 64 patients with chronic kidney disease stage 4 or ESRD who decided to have permanent venous access at Phetchabun Hospital were sent to a general surgeon for evaluation. If physical examination of a patient failed to disclose adequate vessels for AVF (palpable artery with good, strong pulse; forearm cephalic vein 2 mm or larger¹⁰; upper arm Cephalic vein 3 mm or larger¹¹; with continuity), he or she would be advised and transferred to a tertiary-level hospital. During this period, 50 AVFs were performed on 47 patients, by a general surgeon. AVF was performed on an outpatient basis, all under local anesthesia (except one case of Basilic superficialization). The treatment algorithm is shown in Figure 1. Choice of AVF was made on the basis of clinical examination results. Patients were followed at the outpatient clinic two to six weeks after operation, and about once a month thereafter until the fistula was sufficiently matured for cannulation. After initiating dialysis, patients were followed every four months. All patients were followed until June 2015. Follow up evaluations were obtained by medical chart review and telephone contact.

Data were collected retrospectively. Primary outcomes included the maturation rate, the primary patency rate, and the complication rate. Determination

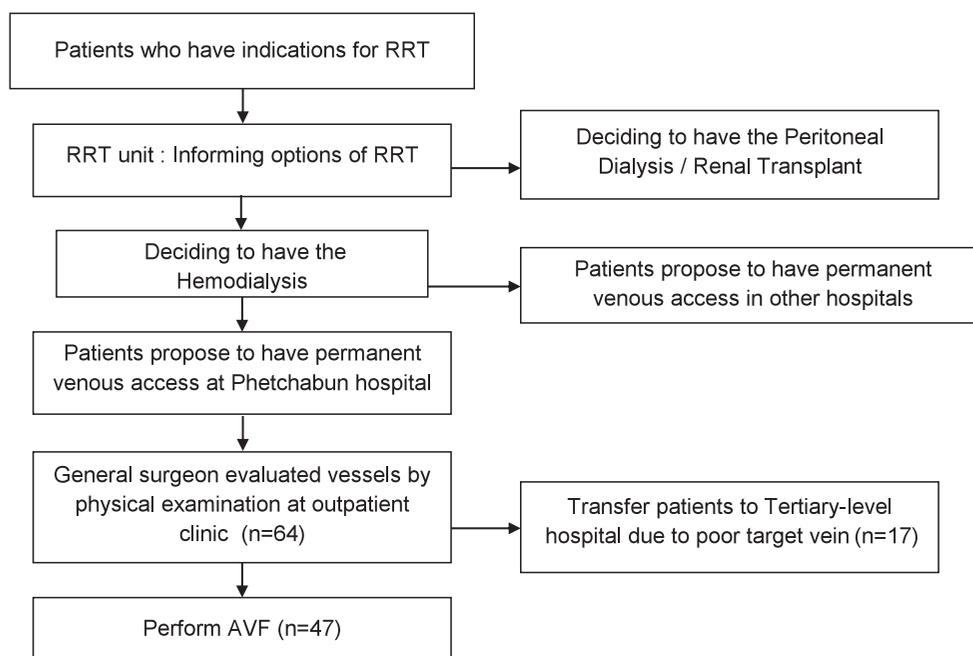


Figure 1 Treatment algorithm of patients who have indications for renal replacement therapy (RRT) at Phetchabun Hospital

of adequate maturation was made by the surgeon on the basis of thrill characteristic and AVF diameter. Primary patency was defined as the interval from the time of access placement until the time of access thrombosis or of the measurement of patency¹². The patency rate was estimated using the Kaplan-Meier method (STATA version 12). Patients whose death was unrelated to access failure were considered lost to follow-up.

RESULTS

Of the 47 patients who underwent AVF at Petchabun Hospital, 64% (30) were men. Their mean age was 52.7 years, with a standard deviation of 15.5 years. Comorbid diseases included diabetes mellitus in 36% (17), hypertension in 68% (32), and smoking in 19% (9) of all patients.

In the present series of patients, 50 AVFs were created (6% Radiocephalic, 92% Brachiocephalic and 2% Brachiobasilic), the maturation rate was 90%, and the mean maturation time was 8.6 weeks, as detailed in

Table 1. The primary patency rate at 6 months, 1, 2 and 3 years were 90%, 87%, 82% and 82%, respectively, as shown in Figure 2. Post-operative hematoma occurred in 4 AVFs (8%). All complications were treated conservatively.

DISCUSSION

The maturation rate in this study was 90%, which was relatively high when compared with past results (30% to 90%)^{13,14,15}. This result might be explained by our assessment of vascular anatomy based only on physical examination, without any imaging evaluation¹⁶. The higher proportion of arm to forearm AVF (94% to 6%) in the present study was similar to findings in past reviews, and the maturation rate of the arm AVF was higher than that of the forearm AVF, especially in patients with diabetes, supporting previous studies as well¹⁵.

In the present study, the primary patency rates at 6 and 18 months were 90% and 87% respectively. When comparing this result to that of a meta-analysis which showed the primary patency at 6 and 18 months to be 72% and 52% respectively¹⁷, our seemingly superior result might be due to the fact that 73% or 47 of 64 patients who underwent AVF were a highly selected group with favorable vascular anatomy. The other 27% or 17 patients had to be transferred elsewhere for further imaging evaluation, or for arteriovenous graft (AVG) placement. This 73% AVF creation rate seemed low when compared with previous studies, which showed AVF creation rates between 75% to 90%^{16,18,19}. However, the rate of AVF creation in the present series was higher than the 65% target set by Fistula First Program, as advocated by the KDOQI²⁰. Also, the proportion of forearm to arm AVF in this study was 6% to 94%, which was lower than that in a previous report showing a proportion of 69% to 31%. This would explain the higher patency rate in the present study as well, since the primary patency rate of arm AVF is higher than that of forearm AVF. For example, the primary patency rate of brachiocephalic AVF at 6 months was 81%, while that of radiocephalic AVF was 71%⁵. Finally, the mean maturation time in the present study was shown to be 8.6 weeks, conforming to the KDOQI clinical practice guidelines that suggested the mean time to be at least between 6 to 8 weeks^{20,21}.

There were 8% (4 out of 50 AVFs) post-operative

Table 1 Types of AVF, maturation rate, and maturation time.

Types of AVF	Number (%)	Maturation rate (%)	Mean maturation time (weeks)
Forearm			
Radiocephalic AVF	3 (6)	1/3 (33.33)	9.0
Arm			
Brachiocephalic AVF	46 (92)	43/46 (94)	8.4
Brachiobasilic AVF	1 (2)	1/1 (100)	16.0
Total	50 (100%)	45/50 (90)	8.6 (range, 4 to 16)

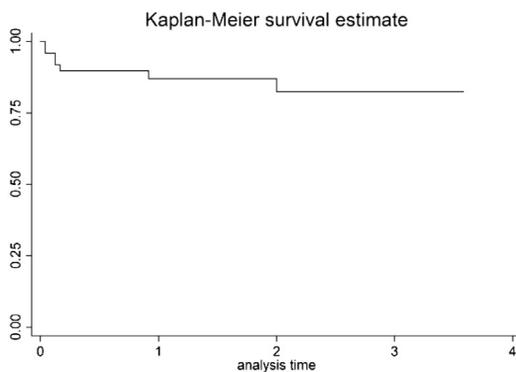


Figure 2 Primary patency rate of arteriovenous fistula in the present study

hematoma, which was the only complication in the present study. This complication was resolved by conservative treatment.

CONCLUSION

The general surgeon in the setting of a secondary-level hospital can perform AVF effectively and safely in selected patients, able to select appropriate type of AVF for each patient, as well as choosing the proper time of initiation of hemodialysis.

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บทคัดย่อ ผลการศึกษาการทำ Autogenous Arteriovenous Fistula โดยศัลยแพทย์ทั่วไป ในระดับโรงพยาบาลทั่วไป

นพ.ธรรมนิตย์ วรวรรณระชัย

กลุ่มงานศัลยกรรม โรงพยาบาลเพชรบูรณ์ จังหวัดเพชรบูรณ์

หลักการและเหตุผล: ในระดับโรงพยาบาลทั่วไปที่ยังไม่มีศัลยแพทย์หลอดเลือด ศัลยแพทย์ทั่วไปมักจะเป็นผู้รับผิดชอบการผ่าตัดทำเส้นสำหรับฟอกเลือดในผู้ป่วยไตวายเรื้อรังที่จำเป็นต้องได้รับการฟอกเลือดด้วยเครื่องไตเทียม ซึ่งยังไม่มีการศึกษาที่ชัดเจนถึงผลของการทำหัตถการนี้ในระดับโรงพยาบาลทั่วไป ดังนั้นผู้วิจัยจึงได้ทำการศึกษาเกี่ยวกับผลของการทำเส้นสำหรับฟอกเลือด ชนิด autogenous arteriovenous fistula (AVF) โดยศัลยแพทย์ทั่วไป ในระดับโรงพยาบาลทั่วไป โดยประเมินผลลัพธ์ของเส้นสำหรับฟอกเลือด จาก maturation rate, primary patency rate และ complication rate

วิธีการศึกษา: ระหว่างเดือนตุลาคม พ.ศ. 2554 จนถึงเดือน พฤศจิกายน พ.ศ. 2557 มีผู้ป่วยโรคไตวายเรื้อรังที่มีข้อบ่งชี้สำหรับการทำการฟอกไตทางเส้นเลือด และตัดสินใจทำเส้นสำหรับฟอกเลือดที่โรงพยาบาลเพชรบูรณ์จำนวน 64 ราย ศัลยแพทย์ได้ทำเส้นสำหรับฟอกเลือดชนิด AVF จำนวน 50 เส้น จากผู้ป่วย 47 ราย ที่ผลการตรวจร่างกายพบว่ามีเส้นเลือดที่สมบูรณ์สำหรับการทำเส้นสำหรับฟอกเลือด ผู้ป่วยได้รับการติดตามการทำงานของเส้นสำหรับฟอกเลือด จนถึงเดือนมิถุนายน พ.ศ. 2558

ผลการศึกษา: มีผู้ป่วยไตวายเรื้อรังที่สามารถทำเส้นสำหรับฟอกเลือดชนิด AVF ที่โรงพยาบาลเพชรบูรณ์จำนวนทั้งสิ้น 47 ราย จาก 64 ราย (คิดเป็น 73%) มีการทำเส้นสำหรับฟอกเลือดชนิด AVF ทั้งสิ้น 50 ครั้ง แบ่งเป็น Radiocephalic AVF 6%, Brachiocephalic AVF 92% และ Brachio basilic AVF 2% อัตราการเกิด maturation คิดเป็น 90% ระยะเวลาเฉลี่ยในการเกิด maturation เท่ากับ 8.59 สัปดาห์ อัตราระยะเวลาการเปิดโล่งปฐมภูมิ (primary patency rate) ที่ 6 เดือน 1 ปี 2 ปี และ 3 ปี คิดเป็น 89% 87% 82% และ 82% ตามลำดับ พบภาวะแทรกซ้อนจากการทำเส้นฟอกไตทั้งสิ้น 8% ทั้งหมดเป็น hematoma

สรุป: ในระดับโรงพยาบาลทั่วไป ศัลยแพทย์ทั่วไปสามารถผ่าตัดทำเส้นสำหรับฟอกไตชนิด AVF ได้ อย่างมีประสิทธิภาพ โดยต้องมีการประเมินและเลือกผู้ป่วยอย่างเหมาะสม เลือกชนิดของ AVF ที่เหมาะสม และพิจารณาเริ่มใช้เส้นสำหรับฟอกไตเมื่อมี maturation สมบูรณ์
