Factors Affecting Patency following Successful Percutaneous Intervention for Dysfunctional Hemodialysis Vascular Access

Sung Min Kim,[1] Heung Kyu Ko,[2] Minsu Noh,[1] Gi-Young Ko,[2] Min-Ju Kim,[3] Tae-Won Kwon,[1] Hee Jin Kim,[1] and Yong-Pil Cho,[1] Seoul, Republic of Korea

Background: This study aimed to investigate the patency following initial successful percutaneous transluminal angioplasty (PTA) for untreated dysfunctional hemodialysis vascular access and to identify predictors of PTA durability.

Methods: This retrospective observational study included data of 132 consecutive initial PTA of hemodialysis vascular access in 126 patients who showed immediate technical and clinical success and had at least 1 year of follow-up data.

Results: The mean duration of primary and secondary patency post-PTA was 16 and 27 months, respectively. On multivariate adjusted Cox regression analysis, dyslipidemia ($P < 0.001$), use of insulin ($P = 0.016$), and arteriovenous graft (AVG) ($P = 0.016$) were significantly associated with shorter primary patency. Dyslipidemia ($P < 0.001$), use of antiplatelet medication ($P = 0.013$), and failed vascular access ($P = 0.004$) were significant predictors of secondary patency loss. Use of statin was the only clinical variable associated with increased primary and secondary patency ($P < 0.001$). According to a subgroup analysis on the type of vascular access and dysfunction, primary and secondary patency rates were significantly higher in the arteriovenous fistula (AVF) and failing vascular access groups than AVG and failed vascular access groups, respectively. Early dysfunction (within 6 months) was significantly higher in the AVG and failed vascular access groups after initial PTA, but there was no significant difference after multiple PTAs.

Conclusions: Post-PTA primary and secondary patency rates were significantly higher with AVF and failing vascular access. The use of statin was associated with increased primary and secondary patency after initial successful PTA in this study.

INTRODUCTION

Establishing and maintaining vascular access patency is an important aspect of patient care in hemodialysis patients.[1,2] Most surgeons advocate a policy of aggressive endovascular and surgical intervention to maintain and restore the patency of arteriovenous fistulas (AVFs) and arteriovenous grafts (AVGs).[3] Percutaneous transluminal angioplasty (PTA) is one of the advances in endovascular procedures for hemodialysis vascular access and has generally replaced surgical procedures because of its improved outcomes and the convenience of performing the procedure in the outpatient setting.[1,4] Although the Kidney Disease Outcome Quality Initiative guidelines officially recognized

Conflict of interests: The authors have no conflict of interests in relation to this article.

Financial disclosure: This report did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sector.

[1]Department of Surgery, University of Ulsan College of Medicine and Asan Medical Center, Seoul, Republic of Korea.

[2]Department of Radiology, University of Ulsan College of Medicine and Asan Medical Center, Seoul, Republic of Korea.

[3]Biostatistics Collaboration Unit, University of Ulsan College of Medicine and Asan Medical Center, Seoul, Republic of Korea.

Correspondence to: Yong-Pil Cho, MD, PhD, Department of Surgery, University of Ulsan College of Medicine and Asan Medical Center, Asanbyeongwon-gil 86, Songpa-gu, Seoul, 05505, Republic of Korea; E-mail: ypcho@amc.seoul.kr

Ann Vasc Surg 2018; 47: 54–61
http://dx.doi.org/10.1016/j.avsg.2017.08.003

Manuscript received: December 3, 2016; manuscript accepted: August 27, 2017; published online: 5 September 2017

the importance of this radiological approach,[5] the durability of PTA is limited, and poor rates of patency following PTA have been observed in AVGs.[6,7] In addition, 50% of AVFs and AVGs that underwent PTA ultimately required repeated interventions; therefore, multiple PTAs are often performed in an attempt to prolong or restore the functional patency of hemodialysis vascular access.[8] Variables affecting patency were also studied in previously reported series, but there were some conflicting results among these studies.[9–11] Furthermore, the ability to predict subsequent failure after initial successful salvage of dysfunctional vascular access by PTA is important from a clinical perspective.

The aims of this study were to investigate the efficacy of an initial successful PTA to preserve and restore the patency of vascular access that had not yet been treated for dysfunction and to identify the predictors of PTA durability.

MATERIALS AND METHODS

Study Design and Patient Population

This retrospective observational study included the data extracted from medical records of patients referred for fistulogram and treatment of dysfunctional hemodialysis vascular access and without previous history of stenosis or occlusion. The study protocol was approved by the institutional review board. The requirement for informed patient consent was waived given the retrospective nature of the study.

The records of 407 consecutive fistulograms for dysfunctional hemodialysis vascular access performed at our institution between January 2010 and December 2011 were analyzed. Of these, 14 cases (3.4%) in whom immediate hemodialysis was not feasible after fistulogram with PTA were excluded. Other exclusion criteria during the study period were diagnostic fistulogram without a PTA (n = 31, 7.6%), over 80 years of age (n = 13, 3.2%), repeated PTAs (n = 124, 30.5%), and central venous stenosis/occlusion (n = 93, 22.9%). The remaining 132 consecutive initial PTA procedures (32.4%) in 126 patients (20–80 years of age) who had immediate technical and clinical success with at least 1 year of follow-up data were included in this study. During this study period, 6 patients underwent PTA of 2 different vascular accesses. The potential risk factors and other clinical characteristics that were previously recorded in an Excel database (Microsoft Corp., Redmond, Washington, USA) were analyzed retrospectively.

Surveillance to Detect Dysfunctional Hemodialysis Access

The unit protocol for monitoring of vascular access included the clinical assessment by the nursing staff for changes in thrill or bruit when needling, and direct measurement of static pressure and calculation of static intra-access pressure ratio by using a pressure measuring device once a month.[5]

Patients were referred for the angiographic evaluation if any of the following criteria appeared: decreased or absent thrill, difficult cannulation, prolonged bleeding time after dialysis, development of collateral veins, persistently elevated dynamic venous pressures unexplained by needle position or size, or abnormal recirculation measurements (>10%). For the AVFs that were not yet in use, the indication for diagnostic fistulogram was inadequate access maturation at 6 weeks or nonfunctioning access at 12 weeks after AVF creation. If deemed necessary, simultaneous PTA was usually performed.

Endovascular Procedures

All endovascular procedures were performed on an outpatient basis at the interventional radiology unit using standard techniques as previously described in literature.[7,12,13] Before treatment, a diagnostic fistulogram using a 22-G needle was performed to obtain images from the cannulation site to the right atrium following infiltration of 2% lidocaine for local anesthesia. A 6F or 7F vascular sheath and guide wire were placed to gain access to the lesion. First, a low-profile and semi-compliant 0.035-in balloon (3–12 mm in diameter) (Mustang™; Boston Scientific, Natick, MA, USA) was used to dilate the obliterated segment. The recanalized segment was eventually dilated to 6–8 mm, depending on the age of fistula and size of the adjacent conduit veins. If the age of the access was <60 days or if the veins appeared small on diagnostic fistulogram, the obliterated segment was dilated to ≤4 mm to avoid rupture. If thrombi in the vascular access were identified on fistulogram, aspiration thrombectomy was performed using a 7F aspiration thrombectomy device (Desilets-Hoffman introducer set; Cook®, Bloomington, IN, USA). Bare metal stents with 6–8 mm in diameter (Zilver; Cook, Bloomington, IN, USA) were used in cases of significant elastic recoil on native vein just after venous anastomosis, which was resistant against sufficient balloon dilatation.

Definitions and Study Endpoints

Vascular access age was calculated as the difference between the time of creation and time of initial PTA. The degree of stenosis before PTA was expressed as a