Annals of Medicine and Surgery 22 (2017) 16–21

Contents lists available at ScienceDirect

Annals of Medicine and Surgery

journal homepage: www.annalsjournal.com

S-shaped versus conventional straight skin incision: Impact on primary functional maturation, stenosis and thrombosis of autogenous radiocephalic arteriovenous fistula
Impact of incision on maturation, stenosis & failure of RCAVF. Study design: Prospective observational comparative

Ali Kordzadeh [a, b, *], Yiannis Panayiotopolous [b]

[a] Medical Sciences, Anglia Ruskin University, Cambridge, UK
[b] Mid Essex Hospitals Services NHS Trust, Department of Vascular, Endovascular and Renal Access Surgery, Broomfield Hospital, CM1 7ET, Essex, UK

HIGHLIGHTS

- S-shaped skin incision is an alternative to the conventional skin incision for creation of radiocephalic arteriovenous fistula (RCAVF).
- This approach permits better exposure for both vessels and minimise the need for extensive mobilisation of cephalic vein.
- S-shaped skin incision is associated with lower incidence of stenosis within the maturation period.

ARTICLE INFO

Article history:
Received 12 June 2017
Received in revised form
25 August 2017
Accepted 26 August 2017

Keywords:
Radiocephalic arteriovenous fistula
Techniques
Incision type
S-Shaped
Maturation
Stenosis

ABSTRACT

Introduction: The objective of this study is to test the null hypothesis that an S-shaped surgical incision versus conventional (straight) skin incision in the creation of autogenous radiocephalic arteriovenous fistulas (RCAVFs) have no impact on the primary end-point of primary functional maturation and secondary end points of stenosis and thrombosis.

Methods: A prospective observational comparative consecutive study with intention-to-treat on individuals undergoing only radiocephalic arteriovenous fistula (RCAVFs) over a period of 12 months was conducted. Variables on patient's demographics, comorbidities, anesthesia type, mean arterial blood pressure, thrill, laterality, cephalic vein and radial artery diameter were collated. The test of probability was assessed through Chi-Square, Kaplan-Meier survival estimator and Log-Rank analysis.

Results: Total of n = 83 individuals with median age of 67 years (IQR, 20–89) and male predominance 83% during this period were subjected to RCAVF formation. Total of n = 45 patients in straight skin incision were compared to n = 38 individuals in S-shaped group. Despite equal prevalence of demographics, comorbidities, anesthesia type, mean arterial blood pressure (MAP), thrill, laterality, cephalic vein and radial artery diameter ($p > 0.05$) higher incidence of juxta-anastomotic stenosis was noted in the straight skin incision group ($p = 0.029$) in comparative and survival analysis (Log-Rank, $p = 0.036$). The maturation of the entire cohort was 69% (S-shaped 76% vs. straight group 62%) ($p > 0.05$).

Conclusion: The outcome of this study demonstrates that S-shaped surgical skin incision is associated with a lower incidence of stenosis in comparison to straight incision type in RCAVF formation.

1. Introduction

The Brescia-Cimino arteriovenous fistula is the gold standard and the primary vascular access choice for hemodialysis patients over the past 50th years [1]. Failure of primary functional maturation (FM) remains a major obstacle and ranges from 10% to 70% in

* Corresponding author. Medical Sciences, Anglia Ruskin University, Cambridge, UK.
E-mail address: Alikordzadeh@gmail.com (A. Kordzadeh).

http://dx.doi.org/10.1016/j.amsu.2017.08.018

different centers [2]. Their failure is associated with significant reliance on temporary dialysis, use of bridging catheters, use of prosthetic conduits; possible central venous stenosis and an overall increase in cost and utilisation of health care resources [3]. To date, various studies have evaluated the impact of different variables on the primary FM of radio-cephalic arteriovenous fistulae (RCAVF) [4,5]. However, only one study to date has evaluated the impact of surgical skin incision on the FM and failure of RCAVF [6]. This study assessed the impact of transverse incision to that of conventional type in practice and was associated with poor outcomes [7].

Traditionally a straight incision given midway between the radial artery and cephalic vein, described by Brescia-Cimino, is the commonest adopted technique worldwide. However, in this approach, the outflow component (cephalic vein) remains directly under the incision line. It has been suggested that tension as a consequence of wound approximation, local inflammatory changes (healing process) and extracellular matrix deposition might result in outflow stenosis and/or thrombosis. In addition, extensive mobilisation of the cephalic vein in conventional method could also result in proximal twisting of the vein on its pedicle [8]. Given majority of stenotic sites are within the 2–3 cm of cephalic vein and from anastomosis site, perhaps a different type of skin incision (S-shaped) might prove beneficial in reducing such adverse events in practice [8].

Therefore, it was hypothesised (null hypothesis) that S-shaped incision in comparison to the conventional (straight skin) method has no impact on the primary end point of functional maturation (FM) and secondary end point of stenosis and thrombosis of autogenous RCAVF.

2. Material & methods

A prospective observational comparative study with intention to treat in (consecutive) patients undergoing only radiocephalic arteriovenous fistula (RCAVFs) at our unit, from 1st of May 2015 to 1st of May 2016 was conducted. Variables included, incision type (s-shaped versus straight incision) (Fig. 1) (Fig. 2) patient's demographics (age, gender), anatomical variance (cephalic vein, radial artery diameter, laterality), comorbidities (Diabetes mellitus (DM), Ischemic heart disease (IHD), congestive cardiac failure (CHF), hypertension (HTN), hypercholesteremia), perioperative variables (anesthesia type (local versus general anesthesia)), presence of intraoperative thrill and/or not) and mean arterial blood pressure (MAP). The primary end point of the study was set at primary functional maturation (FM). The secondary end point was set at the end point of stenosis and thrombosis.

The patients were subjected to two groups of S-shaped and straight incision depending on surgeon's preference (two surgeons)

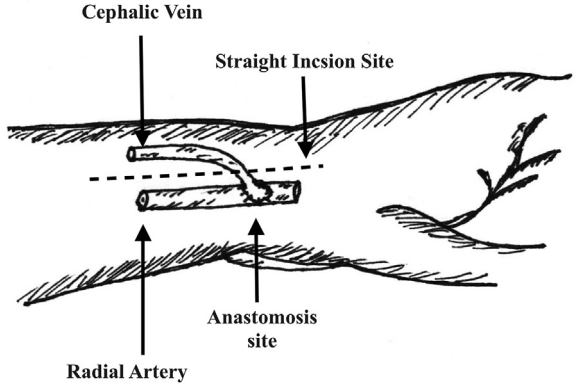

Fig. 1. Conventional straight skin Incision, demonstrating the position of the incision to that of cephalic vein, radial artery and anastomosis on a left hand.

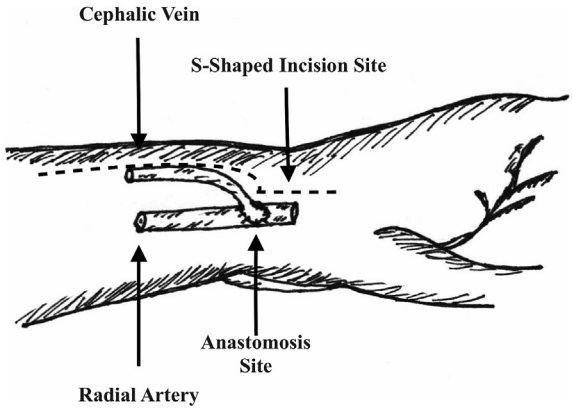

Fig. 2. S-Shaped skin incision, demonstrating the position of the incision to that of cephalic vein, radial artery and anastomosis on a left hand.

of incisions (S-shaped versus straight). In our center, one surgeon performs S-shaped and other, straight incision with equal amount of experience in renal access surgery. The allocation process started from the time of referral (renal physicians) and in preoperative consultation stage. This study was performed with accordance to declaration of Helsinki. The permission to access the renal registry data and this study was granted through clinical audit number CA13-225 obtained from the local trust.

2.1. Definitions

1. Functional maturation was defined against the “Rule of 6's” assessed clinically and with duplex ultrasonography at 6 weeks' post RCAVF formation, with a depth of not more than 0.5–0.6 cm from skin and diameter (main body of fistula) of 6 mm with a flow rate of 600 ml/min and length of 5–6 cm for successful two-needle cannulation and dialysis [9].
2. Stenosis was defined as reduction in the diameter of the vessel by at least >50% and more resulting in reduction of access flow or in measured dialysis dose [10,11].

2.2. Standards

1. The cephalic vein was considered suitable if the “Tap test” (application of tourniquet proximally and percussion of the vein with fingers for vibration across the course of the vein) was positive and the vein was continuous to the median cubitan fossa and/or cephalic vein of arm directly or in directly with a consistent diameter and/or more throughout. Cephalic vein was assessed in non-augmented (no tourniquet) state.
2. The radial artery was used and assessed further with ultrasound only if “Allen's test” was normal (positive) indicating adequate blood flow in ulnar artery and palmer arch. The radial artery was also assessed for hemodynamic studies (flow and stenosis) and not used for RCAVF if changes were noted [12].
3. Preoperative duplex of cephalic vein and radial artery, assessed the internal diameter of both vessels with linear transducer of 5–7 Mhz with arm position fully rested at 45–60° [12].
4. Comorbidities were categorized and defined in accordance with definitions provided by world health organization (WHO) [13].
5. All fistulas were created by an end (cephalic vein)-to-side (radial artery) anastomosis using 2.5× magnifying lenses