

ANEURYSMORRHAPHY FOR HEMODIALYSIS ARTERIOVENOUS FISTULA

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ABSTRACT:

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Background: Pseudoaneurysm is one of the complications of Arteriovenous fistula (AVF), which is associated with an increased risk of thrombosis, infection, bleeding, difficult cannulation for dialysis, pain and cosmetic defects. Aneurysmorrhaphy is one of the successful treatment options for this complication to salvage the fistula and increase its patency rate.

Aim of the work: Venous aneurysm is one of the complications of autogenous arteriovenous fistula (AVF), aneurysmorrhaphy is one of the treatment options that aims to salvage the autogenous fistula and maintain the access. This study aimed to assess the outcomes of aneurysmorrhaphy procedure.

Patients and methods: 13 patients were included in this study all of them had venous aneurysm over autogenous arteriovenous fistula. Patients with infected, thrombosed or who had central venous stenosis were excluded.

Results: The procedure was successful in all patients. Patency rate was 100% for 6 months, the mean AVF diameter was $37. \pm 3.8$ mm before operation 9.3 ± 1.25 mm, 10.5 ± 1 mm, 14 ± 1.25 mm, at 1 month, 3, and 6 months follow up respectively. Complications including limb edema, hematoma formation and infection were minimal.

Conclusion: Aneurysmorrhaphy is a successful procedure for salvage of autogenous arteriovenous fistula with accepted rate of complications.

Keywords: Aneurysmorrhaphy; Arteriovenous fistula; venous aneurysm.

INTRODUCTION:

The Kidney Disease Outcomes Quality Initiative (K-DOQI) guidelines emphasize that autogenous arteriovenous fistula for hemodialysis was recommended as it is less prone to infection and thrombosis than arteriovenous graft⁽¹⁾.

However, it is not free from complications, Venous aneurysm is one of the autogenous AVF complications which should be treated without sacrificing the autogenous access.

Aneurysmorrhaphy is one of the treatment options that aims to salvage the used access and maintain it as long as possible.

Ligation of the fistula and jumping of the aneurysmally dilated segment with a synthetic graft is other treatment option that turns the access from the native vein into a graft.

AIM OF THE WORK:

venous aneurysm is one of the complications of autogenous arteriovenous

fistula (AVF), aneurysmorrhaphy is one of the treatment options that aims to salvage the autogenous fistula and maintain the access. This study aimed to assess the outcomes of aneurysmorrhaphy procedure.

PATIENTS AND METHODS:

After approval of the study by the local ethical committee, all patients who were admitted to Suez Canal University Hospital, Ismailia-Egypt, in the period between October 2022 and March 2023 for aneurysmorrhaphy with the following inclusion criteria were included in the study:

1. ESDR on regular hemodialysis.
2. Has patent and functioning native AVF.
3. That is dilated with a diameter > 18 mm.

While patients who has hypotension, central venous stenosis, infection or patients with total thrombosis of the fistula and also patients refused sharing in the study were excluded.

Procedure⁽²⁾

- Anesthesia: Either general or regional anesthesia.
- surgical technique: After skin preparation, the arterialized vein was circumferentially dissected through a longitudinal incision. Dissection extended distally to a healthy non-aneurysmal zone in the arterialized vein or up to the arterial anastomosis if the dilated venous segment is near to or including the anastomosis. Intravenous heparin was not given because the inflow occlusion time was only a few minutes. Figure (1).

The wall of the aneurysm was opened, and the aneurysmal venous wall was resected followed by suturing of the remaining wall with continuous suture 5/0 polypropylene which should not be greater than 6 mm. When there was excess length secondary to venous tortuosity, the redundant segment was

resected with an end-to-end anastomosis. Figure (2).

The wound was closed over adrain, and a hemodialysis catheter was placed at the time of the operation. The catheter was removed when successful hemodialysis through the saved AVF was achieved two weeks after surgery.

Postoperative Care and Follow-Up:

Post operatively, patients were assessed on the first and second weeks for complications including: limb edema, hematoma, infection or bleeding. Then on the first, third and six months for efficacy of hemodialysis and vein diameter progression.

End of study point:

1. Complications that necessitate discard of the AVF such as: thrombosis or uncontrolled infection.
2. Six months follow up for all cases.

Ethical consideration:

The paper was reviewed by research ethics committee, faculty of medicine, Suez Canal University with number 5227.

RESULTS:

Thirteen patients were included in this study, 5 males and 8 females, with male to female ratio of 1.3: 2. Their age ranged from between 30 and 75 years with a mean of 58.5 ± 14.6 years.

The aneurysmal access was a brachiocephalic fistula in 12 patients (92.3%) and a saphenous vein transposition in one patient (7.7%).

The main indication for aneurysmorrhaphy was the aneurysmally dilated vein of AVF in addition to some clinical indications such as skin necrosis with danger of bleeding in 9 patients (30.7%) and high flow fistula in all patients (100%). The mean ages of the AVFs were 2.5 ± 0.9 years.

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Regarding preoperative duplex evaluation the mean aneurysm diameter was 37 ± 3.86 mm and the mean blood flow rate was 2438.5 ± 320.25 ml/min.

All the patients had more than one dilated segment. The repaired segment/s length ranged between 10 and 15 cm.

General anesthesia was used in 7 patients (53.8%), and brachial plexus block anesthesia was used in 5 patients (38.4%) spinal anesthesia was used in one patient (7.7%).

Operative time ranged between 120 and 180 minutes with a mean of 150 ± 20 minutes. Blood loss ranged between 20 and 30 cc with a mean of 25 ± 5 cc. none of the patients required blood transfusion.

Regarding the postoperative duplex evaluation, the mean AVF diameter was 9.3 ± 1.25 mm, 10.5 ± 1 mm, 14 ± 1.25 mm at 1 month, 3 month, and six month follow up respectively. Diagram (1).

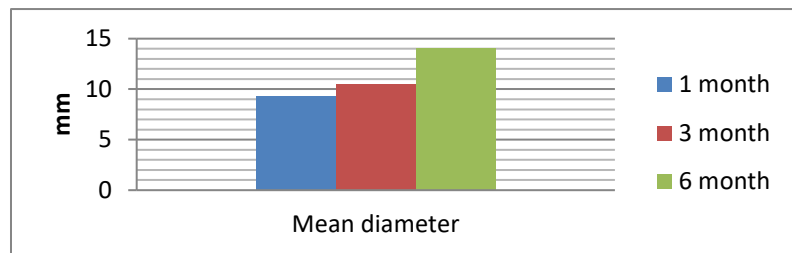


Diagram 1: Postoperative mean AVF diameter at 1 month, 3 month, and six months follow up respectively.

The mean of AVF diameter decreased from 37 ± 3.86 mm preoperative to 14 ± 1.25

mm at six months follow up post operatively, Diagram (2). with a significant P value (0.044).

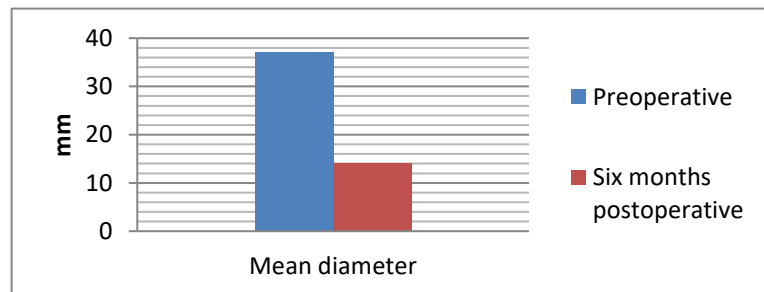


Diagram 2: Comparison between pre and post mean AVF diameter.

The mean AVF flow rate dropped from 2438.5 ± 320.25 ml/min preoperatively to

1369 ± 193.15 ml/min postoperatively Diagram (3) with significant p value (0.003).

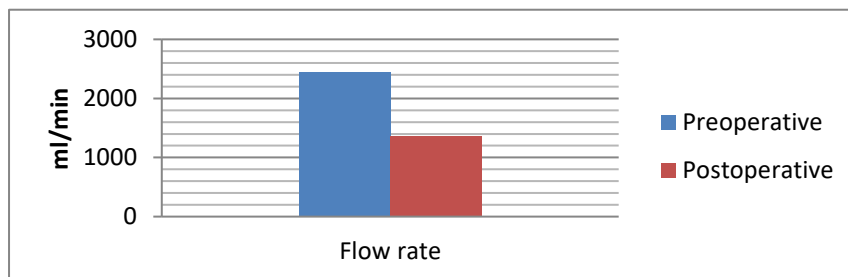


Diagram 3: Comparison between pre and post mean AVF flow rate.

All patients resumed dialysis from the AVF after 2 weeks and by the end of the six months follow up all patients had an effectively functioning AVF.

Regarding post-operative complications there was no infection or thrombosis but only

one patient (7.6%) had edema, haematoma and wound dehiscence due to rupture of distal anastomosis, exploration was done with repair of ruptured distal anastomosis and evacuation of haematoma.



Figure 1: aneurysmorrhaphy of brachio-cephalic AVF.



Figure 2: aneurysmorrhaphy of long saphenous vein transposition into superficial femoral artery (SFA).

DISCUSSION:

Autogenous arteriovenous fistula is preferable for hemodialysis because it is less prone to complications than synthetic one. However, aneurysmal dilatation is the most common complication of this type of fistula.

Uncomplicated aneurysmal AVFs can continue to provide an excellent hemodialysis access for many years; however, in the presence of VA-associated complications, surgical intervention is indicated⁽³⁾. Aneurysmorrhaphy is an option at which salvaging the native autogenous fistula is aimed.

In the present study there were 13 patients, with female predominance, that is contradicted with *Hosny et al.;(2014)*⁽⁴⁾ which had 14 patients but all of them were males.

All patients in our study had an upper arm brachiocephalic AVF except one patient who had lower limb saphenous vein transposition. The same was a little bit different from the study performed in Menoufia Governorate-Egypt on 2014 on a similar population, which included 9 upper arm fistulae (7 brachiocephalic and 2 brachio-basilic transposition), one lower limb saphenous loop and four had radio cephalic AVF. However, these findings may suggest the higher incidence of aneurysmal formation when the vein is connected to a more proximal artery.

Vein diameter was less in the present study when compared to the study performed by *Hosny, et al.*,⁽⁴⁾. It was 37 ± 3.86 mm and 53 ± 16 mm respectively. This may explain the reduced rate of complications in the present study. As relatively less dissection was required.

In spite of aiming at 6 mm vein diameter during aneurysmal refashioning, the mean AVF diameter was 9.3 ± 1.25 mm at 1 month. However, it reached a mean of 14 ± 1.25 mm at the end of the sixth month and this is still

lower than the threshold for AVF aneurysm definition.

In our study the arterialized vein will be circumferentially dissected through a longitudinal incision. The longitudinal incision will be used over diffusely dilated and tortuous venous segments. Dissection extended distally to a healthy non-aneurysmal zone in the arterialized vein. Then the wall of the aneurysm will be opened and the aneurysmal venous wall is resected and the wall is sutured (aneurysmorrhaphy) with continuous suture 5/0 polypropylene without causing stenosis. The whole section of the vein altered by the aneurysm is managed in this way to obtain the required diameter, which should not be greater than 6 mm. When there will be enough excess length secondary to venous tortuosity, the redundant segment will be resected with an end-to-end anastomosis which is different from P. BALAZ et al 2004 study at which external porous poly ethylene terephthalate (PTE) prosthesis was implanted after aneurysmorrhaphy to prevent intimal hyperplasia from their point of view⁽⁵⁾.

In comparison to *Trung vo, et al.*,⁽⁶⁾ who used a stapler to close the aneurysmorrhaphy, in the present study we used a continuous 5/0 polypropylene suture which is much cheaper with the same perfect results.

Recommendations:

1. After completing the study we recommend using red nelton catheter (6mm) by putting it inside the vein before resection of the excess part to determine the accurate diameter we aimed to which was 6mm.
2. We notice that the flow of the fistula after aneurysmorrhaphy still high, so we recommend to use 6mm graft segment for wrapping the proximal 3cm of the fistula to decrease flow to near normal flow.

Conclusion:

Aneurysmorrhaphy is a simple procedure to salvage the autogenous AVF for hemodialysis to maintain its usage with accepted patency and complication rates.

Conflict of interest:

No conflict of interest.

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تقييم نتائج الاصلاح الجراحي فى علاج التمدد الوريدي للوصلات الشريانية الوريدية فى مرضى

الفشل الكلوي المزمن

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المقدمة: لقد أثبتت الدراسات الإحصائية أن حوالي 10 بالمئة من التعداد السكاني على مستوى العالم يعانون من قصور مزمن بوظائف الكلى، حيث يقدر البعض أن ما يقرب من 1.5 مليون مريض يقومون بالغسيل الكلوي سنويا، كما أن هذا المرض في زيادة مطردة، حيث من المتوقع أن يبلغ عدد مرضى الفشل الكلوي 5.4 مليون مريض بحلول عام 2030 ، بينما من ناحية أخرى على الصعيد المحلي في مصر؛ نجد أن مرض الفشل الكلوي منتشر للغاية، كما أوضحت إحصائيات منظمة الصحة العالمية في عام 2017؛ حيث أعلنت أن الوفيات الناتجة عن الفشل الكلوي وحده في مصر تبلغ % 20 من مجمل نسبة الوفيات سنويا.

غالبا ما يلجأ مرضى الفشل الكلوي لجلسات الاستصفاء والغسيل الكلوي، نظرا لصعوبة توفير الخيارات الأخرى من غسيل بريوني، نظرا لقصور الموارد المالية أو لعدم توفر الخدمة، مما يتطلب منهم الخضوع لإجراء عمليات وصلات شريانية وريدية طرفية، أو تركيب قساطر مركزية مؤقتة أو دائمة للغسيل. ومع استمرار وطول فترات الغسيل، يتعرض المرضى لمضاعفات مختلفة لعمليات الوصلات مثل حدوث نزيف أو انسداد أو تمدد وعائي؛ الذي يحدث لتضافر عدة عوامل أهمها ارتفاع الضغط المزمن، ونقرات ثقوب ابر الغسيل المتكررة، مع إعادة هيكلة جدار الوريد جراء تدفق الدم المرتفع في الوصلة.

ومع حدوث التمدد يعاني المرضى من خطر زيادته في الحجم بشكل يهدد بالانفجار والنزيف، أو حدوث عدوى، أو انسداد جزئي أو كلي للوصلة وضعف بتدفق الدم داخلها مما يؤثر على جودة جلسات الاستصفاء و يقف عائقا أمام استمراريتها وما قد يترتب عليها من مضاعفات قد تصل إلى حد الوفاة في حالة حدوث نزيف شديد أو عدوى شديدة.

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و على الرغم من وجود دراسات عديدة على الوصلات الشريانية الوريدية، إلا أن القليل منها يتناول الطرق العلاجية المختلفة لاصلاح التمدد الوريدي، أو المقارنة بينهما من حيث المضاعفات والفعالية قصيرة وطويلة المدى وخاصة في مستشفيات جامعة قناة السويس. لذا قمنا بطرح هذه الخطة البحثية والتي تهدف إلى تقييم نتائج الاصلاح الجراحي لعلاج التمدد الوريدي للوصلات الشريانية الوريدية في مرضى الفشل

الكلوي المزمن ، حيث تهدف هذه الدراسة إلى التوصل عما إن كانت هذه الطريقة العلاجية وسيلة فعالة وأمنة للحفاظ على وصلات الغسيل والقيام بجلسات الاستشفاء الدموي لمرضى الفشل الكلوي، والذي من المحتمل أن يساهم في تحسين نوعية و طبيعة الحياة لدى هؤلاء المرضى.

الهدف من البحث: يهدف هذا البحث إلى دراسة تقييم نتائج الاصلاح الجراحي في علاج التمدد الوريدي للوصلات الشريانية الوريدية في مرضى الفشل الكلوي المزمن في المستشفى الجامعي لطب قناة السويس.

خطة البحث ومنهجية الدراسة:

تصميم الخطة البحثية: دراسة استباقية تداخلية.

محل الدراسة : في وحدة جراحة الأوعية الدموية، قسم الجراحة في مستشفيات جامعة قناة السويس في مصر.

المرضى الخاضعون للبحث: مرضى الفشل الكلوي الذين يعانون من تمدد وريدي على وصلات شريانية وريدية، ويكون هذا مثبتاً بأشعة دوبلكس مرافقة.

المرضى خارج نطاق البحث:

- المرضى الراضين المشاركة في البحث.
- المرضى ذوي الضغط المنخفض.
- المرضى ذوي التهابات في الأوعية الدموية مثبتة طبياً مسبقاً.
- المرضى ذوي انفجار بموضع التوصيل الوريدي الشرياني على الوصلة.
- وجود عدوى شديدة أو خراج بالوصلة.

طريقة البحث: كل المرضى الذين سيتم اختيارهم للدراسة سيتم تحصيل المعلومات الآتية منهم:

- التاريخ الشخصي للمريض: الاسم – السن – العنوان – الوظيفة.
 - التعرض لعوامل الخطر: مرضي السكري، الضغط المرتفع أو المنخفض، عدم انتظام ضربات القلب، قصور بعضلة القلب، التدخين، الكبد الوبائي، زيادة قابلية التجلط، أمراض صدرية.
 - التاريخ التفصيلي لمرض الفشل الكلوي: العمليات السابقة، تركيب القساطر المركزية السابقة، اصلاح تمددات وريدية سابقه.
 - التاريخ المرضي العلاجي: وجود أى حساسية من الصبغة – تناول أدوية سيولة.
 - سيتم عمل فحص أولى للمرضى: قياس ضغط الدم، كشف بجهاز الدوبلكس للكشف عن وجود التمدد قطره، تدفق الدم داخله، وجود علامات عدوى أو خراج، وجود تجلطات جزئية أو كلية، تقييم الشريان العضدي.
 - التحاليل الأساسية: صورة دم كاملة – تحليل بوتاسيوم و صوديوم ووظائف كلي – سيولة الدم – تحليل غازات الدم، ويفضل سحب التحاليل بعد إجراء جلسة الغسيل.
 - سيتم التنبيه على صيام المريض 4 ساعات قبيل إجراء الجراحة، سيتم إجراء الجراحة تحت مخدر منطقي أو كلي.
 - ستم عمل تقييم مبكر للوصلة بعد الجراحة تماماً، وبعد أسبوع، ومن ثم بعد شهر، ومن ثم كل 3 شهور حتى استكمال فترة المتابعة 6 شهور.
 - دواعي انتهاء الدراسة البحثية: انسداد، عدوى بالوصلة - استكمال فترة المتابعة 6 شهور.
- التحليل الإحصائي:** سوف يتم تجميع النتائج وتحليلها إحصائياً وإصدار المقترحات الناتجة عن البحث تبعاً للمعايير الأخلاقية والبحثية المنصوص عليها.