

Delayed Reverse Sural Artery Flap with Skin Pedicle Technique Versus Standard Island Sural Artery Flap for Reconstruction of Lower Leg, Ankle and Malleoli

Abdullah Y. Naeem¹, Albhloly Saeed¹,
Ahmed Almalahy¹, Yasser Abdumughny²
and Taher Aitha¹

1 Department of Surgery, Faculty of Medicine, Thamar University, , Thamar, Yemen.

2 Department of Surgery, Faculty of Medicine, Sana'a University, Sana'a, Yemen.

ABSTRACT

Background and objectives: Standard reverse island sural artery flap is the most common usage for distal third defects of the leg. However many authors reported 36 % complication rate mainly partial or complete flap loss , that is attributed to venous congestion. Delayed reverse sural artery flap in two stages with skin pedicle technique is reliable and less complicated. In this study was compare between the results of both techniques.

Patients & Methods: The study included forty patients presented to AL-Wahda University Hospital and 48 Military Hospital , after trauma of lower leg with complete loss of soft tissue and exposure of underlying structures ,within periods Oct 2013 to May 2017. The patients were thirty male and ten female , their age ranged between fifteen to sixty years old . Reverse island sural artery flap was used in twenty patients, while delayed sural artery flap was used in twenty patients too. The results of both techniques were compared.

Results: In our study the standard reverse island sural artery flap is good option for reconstruction of lower leg , ankle and malleoli defect ,which is performed in twenty patients , the partial necrosis occur in 20% patients and three cases with flap failure ,the venous congestion occur in 35% of patients In this study, we performed reconstruction of the lower leg, heel , and malleoli in another twenty patients by delayed reverse sural artery flap with skin pedicle technique, the flap necrosis occur only in one case and partial flap necrosis occur in two cases only, in comparison with standard technique of reverse island sural artery flap, the venous congestion occur only in four patients 20% , two cases recovering the congestion by leg



elevation and improving the patients hydration , and two cases of venous congestion progressive to partial flap necrosis. Partial necrosis occur in two cases, complete flap necrosis occur in one case and 95% of patients satisfaction in discharge.

Conclusion: The delayed reverse sural artery flap with skin pedicle is very important to avoid of venous congestion and flap failure , especially in old patients , DM , and in patients with peripheral vascular diseases. The goal of our study were achieved , and the patients improved functionally and attained their routine activity. By this technique and modification, make the delayed sural artery flap the first choice in reconstruction of the lower third defect of leg , heel and ankle. and is less postoperative venous congestion and flap failure. Delayed sural artery flap in two stages with skin pedicle technique is convenience and less complication particularly for old patients with diabetes mellitus and peripheral limb ischemia or venous insufficiency.

Keywords: *Lower leg ,ankle and heel defects , standard reverse island sural artery flap, delayed reverse sural artery flap with skin pedicle.*

INTRODUCTION

The common perception about the standard reverse sural artery flap is a high partial or complete flap loss rate. Many authors reported 36 % complication rate in standard reverse sural flap application in reconstruction of lower third of leg , knee , malleoli and forefoot [1,2,6]. The most complication of standard revers island sural artery flap is partial or complete flap loss which is attributed to venous congestion, this high rate of complication makes the flap is a secondary choice in the perception of many surgeons [2-6]. Baumerster, et, al, reported that is 36% complication rate in high risk patients population , including patient with DM and old age. This make the reverse sural artery flap a secondary choice in perception of many surgeons [2].

The standard reverse island sural artery flap is alternative for tissues reconstruction of the lower extremities , particularly the lower third, and ankle, which is prone to traumatic injuries and frequently requires free flap transfer ,because the lack of local tissues, this make the reconstruction likely to be more challenging and time consuming, and the standard reverse island sural artery flap has been welcome by many surgeons in their search for an easy solution to the problem [3]. The maneuvers, such as designing a skin tail for tension free in setting, grafting of adipofacial pedicle, and keeping the pedicle wide and short as possible seem to be important [7-11].

Wu Z, Guan Z, Performed island fasciocutaneous flaps supplied by super fascial sural artery in eighteen patients with distal leg defect. The flap was designed on the posterior aspect of the leg. It ranged in size from 4 by 5 cm to 11 by 12 cm. Sixteen flaps survived completely , and two had partial necrosis. At 2 years follow- up, results were satisfactory in the sixteen patients [12-14].

Zang, performed standard reverse sural artery island flap in twenty patients , they reported and concluded flap is convenient and reliable because it over advantage for then free microscopic surgery with less complication rate such as partial necrosis of the flap and flap failure , which occur in 2 patients [15]. Maffi et, al, performed seven case by delayed reverse island sural flap, the operation was done in two stage with

exteriorized the pedicle. The flaps was survived and there is no venous congestion and all were ambulatory after surgery [6].

AIM OF STUDY

In our study, the high rate of complications in use standard reverse island sural artery flap is mainly venous congestion, which can be avoided by modified the standard procedure by addition procedures such as Delayed reverse sural artery flap in two stage and with long skin pedicle. All of these modification of standard procedure to improve the outcome and decrease the rate of flap necrosis , especially in DM, peripheral arterial diseases , and old patients.

PATIENTS AND METHODS

Prospective study which included the evaluation of the result of delayed reverse sural artery flap technique with skin pedicle in comparison with standard reverse island sural artery flap for reconstruction of lower leg , ankle and malleoli defect. The study included 40 patients presented to AL Wahda University Hospital and 48 Military Hospital in the period from Oct 2013 to May 2017. The patients included 30 male and 10 female, their age ranged between 15 to 60 years old. Fig 1:

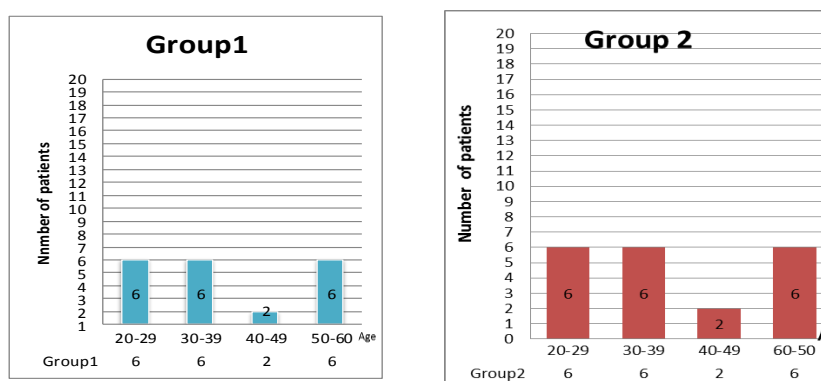


Fig 1: The age and number of patients in two group

The patients were classified according to the techniques used for reconstruction into the following groups;

Group 1; Standard reverse island sural artery flap technique (20 patients); The marking are made with the patient in the prone position. The first land mark in the planning of the flap is the lateral malleolus. Horizontal line is drawn about 5 to 6 cm above the lateral malleolus which represents the turning point of the flap. The skin island of the flap should be slightly larger than the defect to account the skin contraction. The Doppler probe is used to determine the location of vascular pedicle. The flap is elevated under tourniquet control, the flap harvested from the popliteal fossa to

mid-portion of the leg after the patient placed in the prone position. The skin island is raised with deep fascia, the subcutaneous facial pedicles is elevated keeping a width of 2 cm to include the sural nerve and short saphenous vein. The pedicle of the flap should be more than 5cm between the end of the pedicle elevation and lateral malleoli. Determined the pedicle length is mandatory for coverage of the defect. The flap is transposed directly to the defect, then the flap inset to the defect without kinking or compression of the pedicle, then Skin graft for donor site defect. The Standard Reverse Island Sural Artery Flap technique is based on the fasciocutaneous blood supply of the distal posterior lateral leg. It is the most flap usage for reconstruction of defects in the lower third of leg, heel and foot, this flap permits the tissue reconstruction without need microsurgery. The axial arterial flow to the flap is provided by septocutaneous perforators arising from the peroneal artery, these perforators pass between the fibula and the flexor hallucis longus proximally, and between the soleus and the peroneus longus distally. Typically three to six perforators, these perforators are located within 7 cm proximal to lateral malleolus. Also the flap supplied by septocutaneous perforators arising from the posterior tibial artery, this perforators lie within 10 cm of medial malleolus. The vasa nervorum which accompany the sural nerve also important for vascularity of the flap (Fig 2).



Fig 2: Preoperative case of post gun shot, with lower leg defect.

Group 2; Delayed reverse sural artery flap with skin pedicle technique (20 patients);

The delayed reverse sural artery flap can be created by proximal portion of the flap is maintained with skin bridge and the remainder of the flap is dissected as previously described, and complete elevation of the flap below the fascia. This means that the skin island is being supplied by the vessels that normally supply the flap, but the bridge of the skin has been maintained to allow the venous egress. The sural artery, sural nerve and lesser saphenous vein should be divided at the initial elevation, this allows axialization of vessels within the flap overtime. At 7 to 10 days, this area of skin bridge connection can be divided in the outpatient clinic and the flap rotate and inset into position at two weeks. The delayed flap with skin pedicle technique whereby a subcutaneous tunnel is avoided and the pedicle of the flap exteriorized without

alteration of flap design. The venous congestion is one of the weaknesses of the standard reverse island sural artery flap, so one solution is to perform the flap in two stages to avoid the venous congestion. In each case the following were fulfilled; Analysis of the patients complaint, complete medical examination, pre-operative and post-operative photography and follow up after one month and six months (Fig 3).



Fig. 3: postoperative case after 6 months. delayed reverse sural artery flap with skin pedicle

RESULTS

All the patients were followed up postoperatively by venous congestion of the flap, partial flap necrosis, complete flap necrosis and patients satisfaction.

Group 1; Standard reverse island sural artery flap 20 patients (Table 1, 3);

Regarding to venous congestion of the flap , there was seven patients in this group complicated by venous congestion postoperative (35%) and the remaining 13 patients not complicated by venous congestion of the flap (65%), four patients in this group complicated postoperatively by partial flap necrosis of the flap '20% ' and the remaining patients are well, three patients in this group complicated by complete flap necrosis and failure' 15%' , and regarding to patients satisfaction there was eighty five patients in this group satisfaction in discharge ' 85%'. (Fig 4).



Fig 4: 3 day postoperative case show the long skin pedicle of flap , delayed reverse sural flap with long skin pedicle technique.

Table 1: Clinical data of patients in group 1; standard reverse island sural artery flap technique (20 patients)

No	AGE	SEX	Pathology	Venous congestion	Partial flap necrosis	Complete flap necrosis	Patient satisfaction
1	25	M	Lower leg defect	-	--	-	+
2	30	F	lower leg defect	-	-	-	+
3	20	M	Lower leg defect	-	-	-	+
4	30	M	Lower leg defect	-	-	-	+
5	28	M	Lower leg defect	-	-	-	+
6	50	M	Ankle defect	+	+	-	+
7	55	M	Ankle defect	+	-	+	-
8	43	F	Lower leg defect	+	+	-	+
9	35	M	Medial malleolus defect	-	-	-	+
10	50	F	Lower leg defect	+	-	+	-
11	26	M	heel defect	-	-	-	+
12	31	M	Lower leg defect	-	-	-	+
13	23	M	Lower leg defect	-	-	-	+
14	33	M	Lower leg defect	-	-	-	+
15	26	M	Lower leg defect	-	-	-	+
16	52	M	Ankle defect	+	+	-	+
17	58	M	Ankle defect	-	-	-	+
18	47	F	Lower leg defect	+	+	-	+
19	32	M	Malleoli defect	-	-	-	+
20	54	F	Lower leg defect	+	-	+	-

Group 2; Delayed reverse sural artery flap with skin pedicle technique ‘ 20 cases’ (Table 2,3); Four patients in this group complicated with venous congestion of the flap 20% postoperatively, Two patients in this group complicated by partial flap necrosis ‘10%’, One patient complicated by complete flap necrosis’ 5% ‘ and regarding to patients satisfaction ninety five of patients satisfy in discharge ‘ 95%’(Fig 2,3,4).

DISCUSSION

Reverse island sural artery flap is the most common usage for distal third defects of the leg, because the flap permits soft tissues reconstruction without the need for microsurgery , also it does not sacrifice any of the three major arteries to the distal extremities. A common perception about the reverse island sural artery flap is a high partial or complete flap loss rate, because most of partial or complete flap loss is attributable to venous congestion, maneuvers, such as designing a skin tail at the proximal portion of the flap for tension free inset and avoided compression of the flap pedicle in tunneling during inset, and keeping the pedicle is wide and short very important for survival the flap (7).

The aim of present study is the evaluation of the results of modified standard island reverse sural artery flap for lower leg, ankles and malleoli reconstruction. The present study evaluated the results of delayed reverse sural artery flap with skin

pedicle techniques in 20 patients with comparison with standard reverse island sural artery flap in 20 patients as a control cases. All the techniques used for reconstruction of lower leg, ankles and malleoli defects.

Table 2: Clinical data of patients in group 2; delayed reverse sural flap with skin pedicle technique (20 patients)

NO	AGE	SEX	Pathology	Venous congestion	Partial flap necrosis	Complete flap necrosis	Patients satisfaction
1	30	M	Lower leg defect	-	-	-	+
2	25	M	Lower leg defect	-	-	-	+
3	60	F	Lower leg defect	+	-	+	-
4	45	M	Lower leg defect	+	-	-	+
5	20	M	Medial malleolus defect	-	-	-	+
6	28	M	Tissue defect in heel	-	-	-	+
7	48	M	Heel defect	+	+	-	+
8	42	M	Ankle tissue defect	-	-	-	+
9	35	F	Lower leg defect	-	-	-	+
10	20	M	Ankle and dorsum of foot defect	-	-	-	+
11	35	M	Lower leg defect	-	-	-	+
12	60	F	Lower leg defect	-	-	-	+
13	48	M	Lower leg defect	-	-	-	+
14	22	M	Lower leg defect	-	-	-	+
15	25	M	heel defect	-	-	-	+
16	23	M	Medial malleolus defect	-	-	-	+
17	48	M	Heel defect	+	+	-	+
18	32	F	Ankle defect	-	-	-	+
19	32	F	Lower leg defect	-	-	-	+
20	23	M	Ankle defect	-	-	-	+

The patients were classified according to the techniques used for reconstruction into two groups; group 1 used standard reverse island sural artery flap technique in 20 patients , And group 2 used delayed reverse sural artery flap with skin pedicle technique in 20 patients. All the patients were followed up postoperatively by venous congestion of the flap , Partial flap necrosis , complete flap necrosis and Patients satisfaction.(Table 3).

Yang et al, study of vascular anatomy and clinical application of reverse island sural flap, they are performed the reverse island sural flap in 26 patients, twenty four flaps survived, and two developed partial necrosis and Zang , performed reverse island sural flap in 20 patients, they reported and concluded the reverse island sural flap is convenient and reliable because it over advantage for then free microscopic surgery with

less complication rate such as partial necrosis and flap failure which occur in two patients [13,15].

Baumerster and his group also reported that is 36% complication rate in a high risk patients population, including patient with DM and old age, this make the reverse sural artery flap a secondary choice in perception of many surgeons. However, similar risk factors may lead to high complication rates in reconstruction with free tissues transfer as well [2].

Table 3: Parameter and clinical results

Parameter / Groups	Group 1 "20 patients"	Group 2 "20 patient"
Venous congestion	35% 7 cases	20% 4 cases
Partial flap necrosis	20% 4 cases	10% 2 cases
Complete flap necrosis	15% 3 cases	5%
Patient satisfaction	85% 17 cases	95%

Many authors reported 36% complication rate, this high rate of complication makes the reverse sural artery flap a secondary choice in perception of many surgeon. In our study the standard reverse island sural flap is good option for reconstruction of lower leg, ankle and malleoli defect, which is performed in 20 patients, the partial necrosis occur in 20% patients and two cases with flap failure, the venous congestion occur in 35% of patients. In this study, we agreement with most of the authors, the complication rate of is between 35% - 40% with partial and complete flap necrosis. The high rate of venous congestion attributed to immediate flap inset and compression of pedicle at the point of rotation and tunneling of the pedicle, this agreement with all the authority (Table 3), (Fig 2, 3).

Venous congestion is one of the weakness of the standard reverse island sural flap, our solution is to performed the flap in two stage. The delayed flap of reverse sural flap can be created by maintain the proximal portion of the flap with the skin, the skin bridge allow the venous egress [2,7].

Maffi, et, al, performed seven reverse sural flap on two stage technique with skin pedicle whereby a subcutaneous tunneling is avoided, and the pedicle is exteriorized without alteration of the flap design. The flaps was survived and there is no venous congestion and flap necrosis. Kose, et, al, also reported that the using delayed reverse sural flap in 10 patients with defect of the foot and ankle. Six patients had at least one risk factor such as DM, peripheral vascular disease, venous insufficiency or 40 years or older. the complication include flap necrosis in one patient and venous congestion in two patient, one response to leg elevation and one to medical leech therapy, the authors recommended this technique for defects too large and patients with risk factors which listed previously [6,5].

Mojallal, et, al, conducted an anatomical study to determine which part of reverse sural flap essential to flap perfusion.the study performed in adult cadaveric. The authors concluded that the cutaneous – venoadipofascial flaps are the best perfusion than the purely fascial flaps , and concluded that deep fascia provided only mechanical support, and did not increase vascular territory of the flap (8) .

Noack et.al, performed 12 cases of distal based reverse island sural flap for heel, ankle and lower leg defect, the authors advice to decrease the rate of complications such as venous congestion and flap necrosis by decrease the pressure on the vessels and an enlarged skin pedicles which harvested the flap with tail of skin over the pedicle at the point of rotation, all the flaps survived with minor complications [9]. Kose et.al, reported that the using delayed reverse sural flap in ten patients with defect of the foot and ankle, six patients had at least one risk factor such as DM, peripheral vascular disease, venous insufficiency or 40 years or older [5]. Chang et. al, modify the standard island sural artery flap to reconstruct the foot and ankle tissues defects in seven patients, they recommended that the delayed reverse sural artery flap and avoided the subcutaneous tunneling of the flaps given better than the standard technique [2].



Fig 5: 3 days postoperative case. Standard reverse island sural artery flap with partial necrosis and congested flap.

The present study we agreement with Chang et al, Noack et.al. and Maffi et.al, we performed reconstruction of the lower leg, heel, and malleoli in 20 patients by delayed reverse sural artery flap with skin pedicle technique to avoided the compression of the flap pedicle at the point of rotation, the flap necrosis occur only in one case and partial flap necrosis occur in two cases only, in comparison with standard technique of reverse island sural artery flap, the venous congestion occur in four patients 20%, two cases recovering the congestion by leg elevation and improving the patients hydration, and two cases of venous congestion progressive to partial flap necrosis , partial necrosis occur in 2 cases, complete flap necrosis occur in one case and 95% of patients satisfaction in discharge. Fig 5:

So recommended that the delayed reverse sural artery flap with skin pedicle procedure over the immediate standard island sural artery flap transfer. Delayed reverse sural artery flap implies redirecting the blood flow by either transecting the vessels or by incising the lateral edge of skin flap. **Fig 2, 3, 4.**

Regarding to the correlation between the technique used for reconstruction and the age of the patients. In group 1, there are eight patients with age ranged from 40 years old to 60 years old. partial flap necrosis occur in 4 patients 50% and complete flap necrosis occur in three cases 33%. In group 2, there are also eight patients with age ranged from 40 years old to 60 years old. partial flap necrosis occur only in 2 patients 25% and only one case with complete flap necrosis 12.5%. Our results regarding to age of patients similar to kosi [5], which used delayed technique in 6 patients with age ranged from 40 years old to 60 years old, the complete flap necrosis occur only in one patient 10.40% (Fig 1,4).

CONCLUSION

The delayed reverse sural artery flap with skin pedicle is very important to avoid of venous congestion and flap failure, especially in old patients, DM, and in patients with peripheral vascular diseases. the goal of our study were achieved, and all the patients improved functionally and attained their routine activity, the modified delayed reverse flap technique is the first choice flap usage for reconstruction of defect of the lower third defect of leg , heel and ankle.

By this technique and modification make the delayed sural artery flap the first choice in reconstruction of the lower third defect of leg, heel and ankle and is less postoperative venous congestion and flap failure.

RECOMMENDATION

The distal based reverse island sural artery flap is the most flap usage for reconstruction of defects in the lower third of leg , heel and foot, this flap permits the tissue reconstruction without need microsurgery. Many authors reported 36% complication rate, this high rate of complication makes the reverse sural artery flap a secondary choice in perception of many surgeons.

Venous congestion is one of the weaknesses of the reverse island sural artery flap, One solution is to perform the flap in two stages. The major disadvantage of the reverse island sural artery flap for reconstruction the distal third of the leg , ankle and heel is compression of the pedicle within the subcutaneous tunnel lead to venous congestion of flap. Skin pedicle technique for this flap whereby a subcutaneous tunnel is avoided and the pedicle of the flap exteriorized without alteration of flap design. Using delayed sural artery flap in two stage with skin pedicle technique is convenience and less complication then the standard island sural artery flap especially for old patients with DM, peripheral limb ischemia or venous insufficiency.

ACKNOWLEDGEMENTS

First and foremost thanks to GOD, the most beneficial and merciful. I would like to express my great indebtedness and gratitude to Prof. DR. TALEB ALNAHARY, president of Thamar University for help and cooperation. I would like to thank Prof; AMATELKHALIQE MEHRASE, professor of gynecological and obstetric , Dean of faculty of medicine, Thamar University for great help and continuous advice. I also

would like to thank Prof; SAEED ALBEHLOLY, Professor of surgery, head of surgical department, Thamar University.

REFERENCES

- [1] **Change SM, Zhang F , Yu GR , et al.** Modified distally based peroneal artery perforation flap for reconstruction of foot and ankle. *Microsurgery* 24; 430 , 2004.
- [2] **Baumeister SP , Spierer R , Erdmann D , et al.** A realistic complication analysis of 70 sural artery flaps in a multimorbid patient group. *Plast Reconstr Surg* 112:129-140; discussion 141-142 , 2003
- [3] **Donski S , Tunuma K , Wakiri I , et al.** Clinical and vascular anatomical study of distally based sural flap. *Ann. Plast Surg* 61:73-78 , 2008.
- [4] **Erdmann D , Gottlieb N , Humphrey JS , et al.** Sural flap delay procedure; a preliminary report. *Ann Plast Surg* 54:562-565, 2005.
- [5] **Kose R , Mordeniz C , Sanli C.** Use of expanded reverse sural artery flap in lower extremity reconstruction. *Foot Ankle Surg* 50:695-698 , 2011.
- [6] **Maffi TR , Knoetgen J III , Turner NS , et al.** Enhanced survival using the distally based sural artery interpolation flap. *Ann Plast Surg* 54:302-305, 2005.
- [7] **Michael R , Glyn J ; Nahai & Mathes ;** Reconstructive surgery ; Anatomy , Technique and Clinical Application ; 1657; 1681 , 2012
- [8] **Mojallal A , Wong C , Bailey S , Rohrich R , Saint-Cyr M.** On “Maximizing the reliability and safety of the distally based sural artery flap (*J Reconstr Microsurg* 2008;24:589-594) , “ *J Reconstr Microsurg* 25:393, 2009.
- [9] **Noack N , Hartmann B , Kuntscher MV.** Measures to prevent complications of distally based neurovascular sural flaps. *Ann Plast Surg* 57:37-40, 2006.
- [10] **Suga H , Oshima Y , Harii K , et al.** Distally – based sural flap for reconstruction of the lower leg and foot. *Scand J Plast Reconstr Surg Hand Surg* 38;16-20,2004.
- [11] **Wong CH , Tan BK et ,al .** Maximizing the reliability and safety of distally based sural artery flap. *J Reconstr Microsurg* 24:589-594 , 2008.
- [12] **Wu Z , Guan Z.** [Emergency repair of skin and soft tissue defects of the lower limbs with island fasciocutaneous flap supplied by superficial sural artery] *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi* 18:307-308 , 2008.
- [13] **Yang DP , Fang DY , Guo TF , et al.** Vascular anatomy and clinical application of the distally based superficial sural artery island flap . *Zhongghua Zheng Xing wai Ke Za Zhi* 20;24 – 6, 2004.
- [14] **Yao SQ , Zhang FQ , Pan JS , et al.** Modified distally based sural flap in acute traumatic forefoot reconstruction. *Ann Plast Surg* 63; 77-80, 2009.
- [15] **Zang F , Lin S , song Y et al.** Distally based sural neuro- lesser saphenous veno-fasciocutaneous compound flap with a low rotation point ; Microdissection and clinical application . *Ann Plas Surg* 62; 395- 404, 2009.

دراسة نقل الأنسجة المجنحة العكسية مع الوعاء الدموي من اعلي الرجل وذلك علي مرحلتين بالمقارنة مع الطريقة الموحدة عالميا على مرحله واحدة وذلك لترميم وتغطية الجروح في اسفل الرجل والمفصل ومشط القدم

عبدالله نعيم¹، سعيد البهلولي¹، أحمد الملاحي¹، ياسر عبدالمعني²، ظاهر عيضة¹

1 قسم الجراحة، كلية الطب، جامعة ذمار، ذمار، اليمن
2 قسم الجراحة، كلية الطب، جامعة صنعاء، صنعاء، اليمن

ملخص

لقد تم تقسيم المرضى حسب الطرق المستخدمة الى مجموعتين المجموعة الاولى: الطريقة المستخدمة تقليديا وهم عشرون مريض المجموعة الثانية: الطريقة المعدلة علي مرحلتين وهم عشرون مريض
الطريقة :

الطريقة المستخدمة يتم تعديل الطريقة التقليدية في نقل النسيج الشورال المرنج على مرحلتين حتى يقلل من اجتماعه حصول المضاعفات وهي بنسبه 35% عالميا ومتفق عليها . تم عمل عشرون حاله بالطريقة التقليدية وعشرون حاله بالطريقة المعدلة علي مرحلتين. تم اخذ صور قبل العملية وبعد العملية بشهر وبعد ثلاثة اشهر وستة اشهر. وايضا مراقبه حدوث احتقان للنسيج او موت جزئي او كلي والاخذ بعين الاعتبار بالرصى للمريض .
النتائج :

لقد اثبتت النتائج الإكلينيكية ان الطريقة الثانية المستخدمة علي مرحلتين اعطت نتيجة افضل والتقليل من نسبه حدوث المضاعفات من 35% الي 20% ونسبه فشل كلي نقل الأنسجة الشورال المجنحة قلت من 20% الي 5% .

الاستنتاجات :

الطريقة المعدلة للعملية على مرحلتين اضافت نقله نوعيه في تقليل نسبه المضاعفات من 35% الي 20% وتقليل نسبه فشل العملية من 20% الي 5%. كما ان الطريقة للعملية علي مرحلتين مهمة جدا في الامراض الذين هم عرضه لفشل عمليه الترميم مثل كبار السن الأمراض اللذين عندهم تصلب الشرايين وامرض السكري

الكلمات المفتاحية: العيوب السفلى في الكاحل والكاحل والعارضة ، وغطاء الشريان الجناحي المعكوس للجزيرة القياسية ، وتأخر اللوح الخلفي للشريان الجسدي مع عنيق الجلد.