

Case Report

Management of extensive nerve gaps of more than 5 cm by vein graft in three cases

Sudhir Singh*

Department of Plastic Surgery, Getwell Hospital, Varanasi, Uttar Pradesh, India

Received: 03 April 2020

Revised: 16 May 2020

Accepted: 18 May 2020

***Correspondence:**

Dr. Sudhir Singh,

E-mail: s.sulekha@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

The aim of this study was to evaluate the effectiveness of use of extensive vein grafts to manage nerve gap repair. The study on peripheral nerve injury has been carried out in this country as well as abroad for many years, but the use of veins as the conduit is more than three decades old and still in evolving phase for standard clinical procedure. Its application is simple and regeneration of nerve is quite satisfactory specially for nerve gap of less than 5 cm. However, the present study was done on extensive nerve gaps of more than 5 cm to 10 cm gaps specially of after long duration of injury to see the results. In spite of poor results due to extensive nerve gap and treatment tried after long duration of injury, it is quite encouraging to see nerve growth in biopsy of one venous tube and it is great achievement for future study. As of now any vein tube applied for nerve gap of more than five cm is not successful. So successful use of venous tubes is still in infancy for nerve gap of more than 5 cm.

Keywords: Nerve gap, Vein graft, Venous tube, Nerve growth in vein conduit

INTRODUCTION

There is a great interest in nerve injury and regeneration, not only from surgeons, but also from basic scientists.^{1,2} The future will likely see the use of nerve tubes or conduits so that nerve grafts will not have to be taken from other areas in the body. Such venous tubes may even be used for a nerve repair, deliberately leaving a small gap between the nerve ends to put into the body's natural messengers to guide regeneration.

The study on peripheral nerve injury has been carried out in this country as well as abroad for many years, but the use of veins as the conduit is more than three decades old and still in evolving phase for standard clinical procedure. Its application is simple and regeneration of nerve is quite satisfactory specially for nerve gap of less than 5 cm.³⁻⁷ The present study was done on extensive

nerve gaps of more than 5 to 10 cm gaps specially of after long duration of injury to see the results.

CASE REPORT

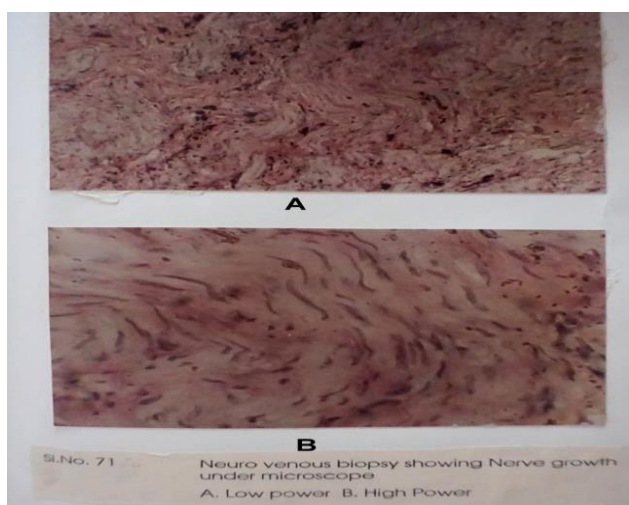
The present study was based on the observations and evaluation of the progress of the three patients after operation. The study design included only three cases of nerve gap of different etiology in which nerve gap were managed using the novel technique of venous tube to see the benefit during 1991 to 1994 period conducted in IMS, Varanasi. Total 90 cases were seen of nerve injury and randomly three cases were taken for this venous conduit study for evaluating its probable role in extensive nerve gap as it was known that for smaller defects there were encouraging results especially in 5 mm nerve gaps.

Table 1: Venous tubulation.

Case no.	Months					Mode of injury	Duration (months)	Nerve	Treatment
	1	2	3	6	9				
71	S-	S-		S-	S-	Gun shot	32	Right Radial	Given 10cm venous tube in 1991, Venoneuronal biopsy done+ tendon transfer in 1994.
	M-	M-		M-	M-	Upper arm (R)			
79	S-	S-	S-	S+	-	Road traffic accident	12	Ant.tibial+ personeal (L)	9.6 cm venous tube for Ant.tibial
	M-	M-	M-	M-	-				
87	S-	S-	S+	S++	-	Vascular tumor from median nerve (R)	40	Median nerve ()	6 cm venous tube
	M-	M-	M-	M-	-				

Note: M+= grade II motor power, S+ = 25% sensation, M++= grade III motor power, S++ = 50% sensation, M+++ =grade iv motor power, S+++ = 75% sensation, M++++(N) =normal motor power, S++++(N) =normal sensation.

The saphenous vein was harvested to bridge the nerve gap in which the distal part of vein lumen wall was anastomosed with proximal freshened margin of epineurium of nerve by interrupted 8/0 ethilon stitches and similarly the proximal lumen of vein is anastomosed to distal cut edge of nerve under microscope.

**Figure 1: Case number 79. Venous conduit 9.6 cm for ATN (L).****Figure 2: Case number 71. Neuro venous biopsy of right radial nerve gap treated by 10 cm vein conduit.**

The Table 1 reveals that venous tubulation which was used as substitute for nerve graft has failed so far for nine months follow up. It was remarkable to note that Tinel's sign often occurs quite distal to lesion during first postoperative week. This may be due to tube acting as volume conductor transmitting tingling quite low below. Case no. 71 of post gunshot right radial nerve injury of 32 months duration having extensive nerve gap was managed by venous tube of 10 cm but had no recovery and so it underwent tendon transfer. Slicing the venous tube under microscope and veno neural junction biopsy showed positive nerve growth in this case at the time of tendon transfer operation (Figure 2). Similar fate for case no. 79 had 9.6 cm venous tube without any clinical positive results (Figure 1). In the last case no. 87 biopsy of tumour showed to be neurofibroma which was marked by angiomatous proliferation within it with associated haemorrhage. So, in all three cases of venous tubulation of more than five cm length which was applied after long duration of injury had no recovery even after nine months of follow up after operation.

Important findings of the study can be inferred from the (Table 1) that no clinical recovery could be seen in terms of substantial sensory and motor power gain even after 9 months in all three cases. On veno neural biopsy of case no. 71 of right radial nerve treated with 10 cm vein graft at time of tendon transfer operation could detect nerve fibre growth inside the proximal part of vein tube (Figure 2).

DISCUSSION

The concept of using a tube to connect two severed nerve stumps is inherently simple and appealing: nerve stumps are pulled into the ends of a tube or tube like structure. Here it is autogenous vein of suitable diameter which readily accommodates the cut end of nerves at ends without compression and this guides the direction of regenerating axonal processes towards the distal nerve segment while at the same time protecting the regenerating axons from intervening scar tissue or

trauma.^{5,8-12} The protected microenvironment created by the venous conduit contains an enriched milieu of concentrated neurotrophic factors.⁹ A fibrin clot forming between the nerve stumps acts as the scaffold to support the essential migration of Schwann cells and, subsequently, axons. The negative result in our three cases of venous tubulation may be due to long duration of injury of more than 12 months and excessive length of the graft of more than five cms. Only remarkable point we get is early Tinel's sign quite distal to coaptation which may be due to tube acting as volume conductor. Patient case no. 71 who had undergone 10 cm venous tube to bridge radial nerve gap had no motor or sensory recovery but however showed axon fibres under microscope when tube was sliced at places for the content to be inspected just before doing definite tendon transfer operation.¹³ Neuro venous junction biopsy proved the growth of nerve fibres (Figure 2). This shows nerve regeneration in vein conduit do occur but in extensive length it is failing in its aim of getting nerve continuity. This may be due to distal stump influences proximal regeneration and indicate that this influence can act only over a limited distance below 5 cm or volume. Such an influence could consist of humoral agents which support nerve growth and/or outgrowth from the distal stump.

CONCLUSION

Venous tabulation results were poor because it was put after long duration of injury and graft length was quite extensive to show early result. However, it is quite encouraging to see nerve growth in biopsy of one venous tube and it is great achievement for future study. As of now any vein tube applied for nerve gap of more than five cm is not successful. Future of management of injured peripheral nerve lies more in the realms of biochemistry and tissue culture rather than finding out individual nerve fibre under most high-power magnification. More work is being done on successful use of venous tubes and synthetic tubes but still in infancy for nerve gap of more than five cm.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

REFERENCES

1. Terzis JK, Smith. Principles, practices and techniques of peripheral nerve surgery; 1991.
2. Ruiz BJ, Monzonis NA, Piqueras A. Invaginated vein graft as nerve conduit: an experimental study. *Microsurgery*. 1994;15:105-15.
3. Guda CM, Heijke, Klapper PT, Richard P, Dutrieux. Vein graft conduits versus conventional suturing in peripheral nerve reconstructions. *Microsurgery*. 1993;14:584-8.
4. Glorgio A. Bridging nerve defects with combined skeletal muscle and vein conduits. *Microsurgery*. 1993;14:247-51.
5. Chiu DT, Strauch B. A prospective clinical evaluation of autogenous vein grafts used as a nerve conduit for distal sensory nerve defects of 3 cm or less. *Plast Reconstr Surg*. 1990;86:928-34.
6. Lundborg G, Dahlin LB, Danielsen N. Nerve regeneration in silicone chambers: influence of gap length and of distal stump components. *Exp Neurol*. 1982;76:361-75.
7. Siemionow M, Bozkurt M, Zor F. Regeneration and repair of peripheral nerves with different biomaterials: review. *Microsurgery*. 2010;30:574-88.
8. Robinson PH. Nerve regeneration through a two ply-biodegradable nerve guide in the rat and the influence of ACTH 4-9, Nerve growth factor. *British J Microsurg*. 1991;12(6):412-9.
9. Danielsen N, Varon S. Characterization of neurotrophic activity in the silicone-chamber model for nerve regeneration. *J Reconstr Microsurg*. 1995;11:231-5.
10. Dellon AL, Mackinnon SE. An alternative to the classical nerve graft for the management of the short nerve gap. *Plast Reconstr Surg*. 1988;82:849-56.
11. Dahlin LB, Lundborg G. Use of tubes in peripheral nerve repair. *Neurosurg Clin N Am*. 2001;12:341-52.
12. Deal DN, Griffin JW, Hogan MV. Nerve conduits for nerve repair or reconstruction. *J Am Acad Orthop Surg*. 2012;20:63-8.
13. Johnson PJ, Newton P, Hunter DA. Nerve endoneurial microstructure facilitates uniform distribution of regenerative fibers: a post hoc comparison of midgraft nerve fiber densities. *J Reconstr Microsurg*. 2011;27:83-90.

Cite this article as: Singh S. Management of extensive nerve gaps of more than 5 cm by vein graft in three cases. *Int Surg J* 2020;7:2069-71.