Original Article

Latex glove conduit as improvised blood vessel model for microvascular anastomosis training

Rotimi O. Aderibigbe*, S.A. Ademola, I.A. Michael, O.A. Olawoye, A.O. Iyun, O.M. Oluwatosin

Department of Plastic, Reconstructive and Aesthetic Surgery, University College Hospital, Ibadan, Nigeria

ABSTRACT

Background: In the growing need of microvascular surgery in modern-day plastic surgery, financial burden on surgeon or institution can discourage acquisition of skill particularly in the initial phase of laboratory simulation. This article describes the construction of a cheap, easy-to-make blood vessel model.

Materials and method: The model was made using infusion giving set, latex glove, scissors, tape measure and Swan glue CD 308. A cut sheet from the latex glove was rolled twice over two glue-painted segment of the infusion giving set stent. The stents were gently pulled out, turning the sheet into a conduit. The blood vessel model was then allowed to dry.

Discussion: The use of latex glove for initial training in microvascular anastomosis has been for long. Previously described productions into a conduit are cumbersome. This model is easy to construct and is useful in an office or dry laboratory setting.

Conclusion: The latex glove blood vessel model described in this article is a useful material in the training of budding microsurgeons. Residents in our institution have reported a very good learning experience with its use.

© 2020 The Authors. Published by Elsevier Ltd on behalf of British Association of Plastic, Reconstructive and Aesthetic Surgeons. This is an open access article under the CC BY-NC-ND license. (http://creativecommons.org/licenses/by-nc-nd/4.0/)

* Corresponding author.
E-mail address: rotyme80@yahoo.co.uk (R.O. Aderibigbe).

https://doi.org/10.1016/j.jpra.2020.02.001
2352-5878/© 2020 The Authors. Published by Elsevier Ltd on behalf of British Association of Plastic, Reconstructive and Aesthetic Surgeons. This is an open access article under the CC BY-NC-ND license. (http://creativecommons.org/licenses/by-nc-nd/4.0/)
Introduction

The importance of microvascular surgery in modern-day plastic surgery cannot be over emphasized.\(^1\) It affords the reconstructive surgeon the ability to use microvascular free tissue transfer as part of the reconstructive armamentarium. Free flaps offer almost limitless reconstructive possibilities and afford the opportunity of successful composite tissue transfer.\(^2\) Acquisition of microvascular surgical skills requires dedication, intensive training and regular practice. In spite of the value of microvascular surgery, young surgeons have limited opportunities to develop these skills in the clinical setting. Microsurgery requires working on delicate structures with high probability of vascular spasms or anastomotic leak such that the real consequence is total failure or absolute success.\(^3\) It is therefore essential to acquire the skill and master the art by simulation outside the clinical setting.\(^4\) However, simulation laboratories with necessary equipment are not common in resource constrained areas and setting up microvascular laboratory is costly. Similarly, in the institutions where the laboratory is available, ideal microvascular kits necessary for multiple practice are difficult to come by and are expensive. This financial burden on the surgeon or institution of training could discourage acquisition of skills. This article describes the construction of a cheap, easy-to-make blood vessel model from readily available latex gloves that is being used in the training of resident doctors on microvascular anastomosis at the University College Hospital, Ibadan.

Materials and method

The materials

The materials used for the construction of the blood vessel model are:

1. Infusion giving set;
2. Latex glove;
3. Scissors;
4. Tape measure;
5. Swan glue CD 308.

All these materials (Figure 1) are readily available.

The construct
Figure 2. Stents placed/glued on the cut edge of the glove sheet.

Figure 3. Latex glove conduit.

About 7-cm length of the latex glove was marked and cut into a rectangular sheet. Avoiding the curved portion of the infusion giving set, two straight segments of unequal length were cut out using scissors. Both infusion giving segments served as a stent in molding the latex glove sheet into a conduit during the production of the blood vessel model. One end of the stents, long enough to cover the width of the glove sheet were painted with low viscous glue (Swan glue CD 308) circumferentially. The stents were then placed/glued on the cut edge of the glove sheet (Figure 2).

The stents were synchronously rolled 360° to wrap the latex glove sheet around it, thus converting the sheet into a conduit. In order to reinforce the wall of the conduit and prevent easy collapse of the wall during use, the area of the glove sheet just beyond the newly formed tube of latex was painted with a thin film of glue and a second turn of the stent was made to convert the single-walled conduit to a double walled. The blood vessel model (Figure 3) was then cut out from the latex glove sheet and the stents gently pulled out, avoiding pressure on the conduit. The glue was allowed to dry. Many more can subsequently be made with the remaining glove sheet and the stents.

Discussion

Several biological and physical models have been described for microsurgical training as well as simulating microvascular anastomosis in the laboratory.
The living animal model, using rats is considered the current gold standard of microvascular training\(^6\) offering a dynamic circulation. However, stringent ethical issues and increasing expenses in running animal laboratories make access difficult for regular and sustained training. Use of living animal model as the starting point in microvascular training may also lead to frustration of the trainee who has not been previously exposed to microvascular surgery and may not have acquired the skill of eye – hand coordination. Non-living animal models, including the use of chicken thigh and wing, equally offers a practice experience that resembles a clinical setting. It requires no institution review board approval, rodent anesthesia or postoperative care unlike the living animal model, but it also has the drawback that it requires the use of a wet laboratory setting that limits its use for repeated and frequent practice.

Latex gloves for initial training in microvascular anastomosis have been in use over time as ‘cut in a glove’. Fashioning it into a form of conduit for anastomosis has also been described.\(^7\)–\(^9\) However, previously described productions into a conduit are cumbersome and the materials may not be commonly available. We have described the use of readily available materials to improvise the blood vessel model for microvascular anastomosis. The model is easy to construct and useful in an office or dry laboratory setting. Although, the haptic feedback is not exactly the same as the animal model, it affords the trainee the opportunity to practice using the vascular clamps, practice orientation technique, suture the anterior and posterior wall using a 9-0 suture satisfactorily and check the integrity of anastomosis using a dye test all of which a ‘cut in a glove’ will not offer. It also allows the dexterity test of needle placement and improvement on speed of suturing. It therefore reduces the steep learning curve associated with the training on a living model. The cost of production of at least 10 of the improvised blood vessel is estimated at less than $1 as compared to $14 per microvessel (3-Dmed). This will lead to significant cost saving in acquiring skills of microsurgery, particularly in low resource settings.

Conclusion

The latex glove blood vessel model described in this article is a useful and cost-effective material in the training of budding microsurgeons. Residents in our institution have reported a very good learning experience with its use.

Declaration of Competing Interest

None declared.

Funding

None.

Ethical approval

Not required.

References

1. Viterbo F. The importance of microsurgery in plastics. Rev Bras Cir Plást. 2012;27(1):02.
2. Pinsolle V, Reau AF, Pelissier P, Martin D, Baudet J. Soft-tissue reconstruction of the distal lower leg: are free flaps the only choice? Review of 215 cases. J Plast Reconstr Aesthet Surg. 2006;59:912–918.
3. Yasargil MG. From the microsurgical laboratory to the operation theatre. Acta Neurochir. 2005;147:465–468.
4. Ghanem AM, Hachach-Haram N, Leung CC, Myers SR. A systematic review of evidence for education and training interventions in microsurgery. Arch Plast Surg. 2013;40(4):312–319.
5. Byvaltsev VA, Akshulakov SK, Polkin RA, et al. Microvascular anastomosis training in neurosurgery: a review. Minim Invasive Surg. 2018;2018.
6. Shurey S, Akelina Y, Legagneux J, Malzone G, Jiga L, Ghanem AM. The rat model in microsurgery education: classical exercises and new horizons. Arch Plast Surg. 2014;41(3):201–208.
7. Guler MM, Rao GS. Canniesburn “ever-ready” model to practice microsurgery. Br J Plast Surg. 1990;43:381.
8. Kamath JB, Kamath SJ. A custom-made latex conduit for simulation of microvascular repair. *Plast. Reconstr. Surg.* 2007;119:1634.

9. Shakeel Dustagheer Alastair P. Brown synthetic latex conduits as an aid for microsurgical training. *Plast Reconstr Surg.* 2008;122(1):321.