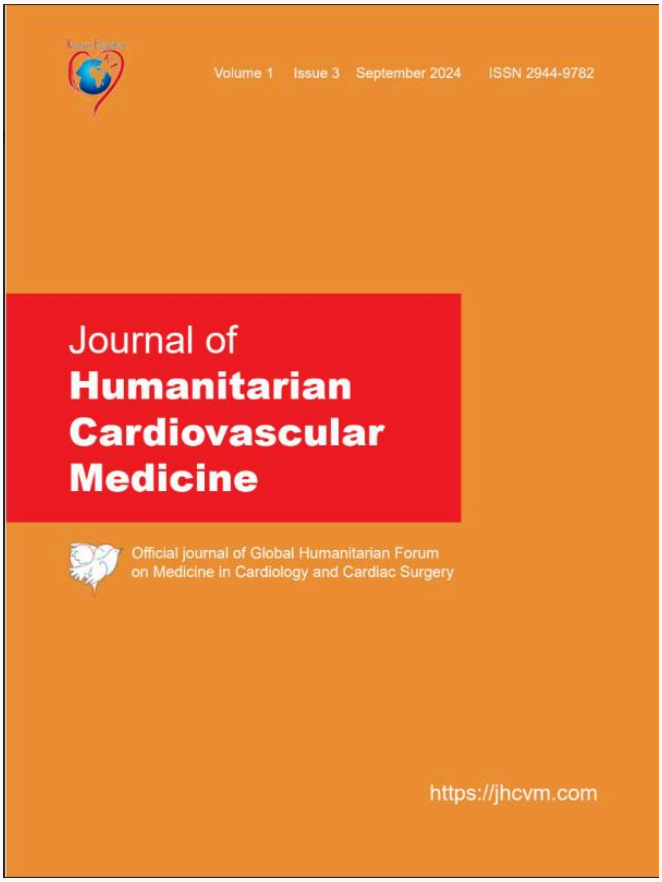
Journal of Humanitarian Cardiovascular Medicine

Vol 1, No 3 (2024)

V1, Issue 3



A DIFFERENT SURGICAL TECHNIQUE FOR FINDING EMBEDDED LAD LOCALIZATION: "SEARCH TECHNIQUE WITH INCISIONS PERPENDICULAR TO THE LAD"

Mustafa Unal, Md. Dr. Abdiashim Tashmamatov, Md. Dr Asan Nazarov Nazarov, Damirbek Osmonov

doi: 10.12681/jhcvm.37602

To cite this article:

Unal, M., Tashmamatov, M. D. A., Nazarov, M. D. A. N., & Osmonov, D. (2025). A DIFFERENT SURGICAL TECHNIQUE FOR FINDING EMBEDDED LAD LOCALIZATION: "SEARCH TECHNIQUE WITH INCISIONS PERPENDICULAR TO THE LAD". *Journal of Humanitarian Cardiovascular Medicine*, *1*(3). https://doi.org/10.12681/jhcvm.37602

Journal of Humanitarian Cardiovascular Medicine

A different surgical technique for finding embedded lad localization: “search technique with incisions vertical to the lad”

Mustafa Ünal, MD[1], Dr. Abdiashim Tashmamatov, MD[1], Asan Nazarov, MD[1], Damirbek Osmonov, MD[2]

[1]Department of Cardiovascular Surgery, Bicard Clinic, Bishkek, Kyrgyzstan

[2]Department of Cardiology, Bicard Clinic, Bishkek, Kyrgyzstan

Corresponding author
Mustafa Ünal, MD, Department of Cardiovascular Surgery, Bicard Clinic, Bishkek, Kyrgyzstan
E-mail address: dr_mustafa_unal@hotmail.com

Keywords
Finding the embedded LAD, right ventricular perforation repair, cardiac physiology

Abstract

Performing an anastomosis to the desired location of the left anterior descending artery (LAD) is not always easy for cardiac surgeons. The techniques described to solve this problem have advantages and disadvantages. Low likelihood of complications and easy to repair if they occur; We believe that it is a technique that has a rapid learning curve, does not cause coronary intimal damage, does not require additional equipment, and is suitable for the morphology and physiology of the heart; We wanted to define the “LAD search method with vertical incisions”.

Introduction

Left anterior descending (LAD) is the most commonly bypassed vessel during coronary bypass (CABG) surgery. Optimal LAD revascularization is one of the most important goals of bypass surgery. Additionally, in most patients, the LAD is located deep within the epicardial fat and muscle in the proximal first third and then progresses towards the epicardial surface. However, in approximately 17-20% of patients requiring surgical revascularization, the LAD is found in the interventricular septum or deeply buried. The presence of a buried LAD artery is a very important problem encountered in coronary bypass surgery[1,2]. Because the LAD is deep and intramuscular, it may cause serious problems in LAD exploration or prevent anastomosis to the ideal location. Managing this problem is often difficult and prone to complications. Various techniques described in the literature have advantages and disadvantages. These may include advancing proximally by retrograde dissection from a visible distal part of the LAD, or a diagonal branch, or advancing a retrograde probe proximally through an arteriotomy performed in the distal LAD[3].

The most important problem that may occur is the complication of right ventricular perforation (RVp). Repair of this or control of bleeding that may occur may negatively affect the LAD and its anastomosis. Another problem is that surgeons perform anastomoses in the distal segment where the LAD is superficial. In this location, the LAD may be small in diameter and affected by atherosclerosis, and therefore a bypass may have been performed whose long-term patency may not be as desired. However, the intramuscular segment of the LAD is generally free of atherosclerosis and has a much larger caliber, but its more superficial distal part is thin enough to make anastomosis difficult and prevent it from being performed to the desired quality, and it is technically difficult to bypass.

In addition, It can take 20-30 mins to dissect out a a deep intramuscular LAD artery, prolonging the cross clamp time. There is bleeding from the epicardial veins or the muscle itself. This bleeding may not be apparent while the aortic cross clamp is on but can become bothersome when the heart is reperfused and beating[4,5].

Our aim is to present a different surgical technique that allows the invisible LAD to be easily found and the defect to be repaired easily and without complications in case of RVp complication.

Technique

First of all, it is useful to explain which physiological and morphological features of the heart we develop by taking into account.. The most important reference point of our technique is the knowledge that the RV muscle fibers are perpendicular to the septum and LAD. Therefore, the short axis is stretched during contraction (Figure 1). The tension is highest basally and lowest near the apex[1]. The tension vector here is perpendicular to the septum and LAD.

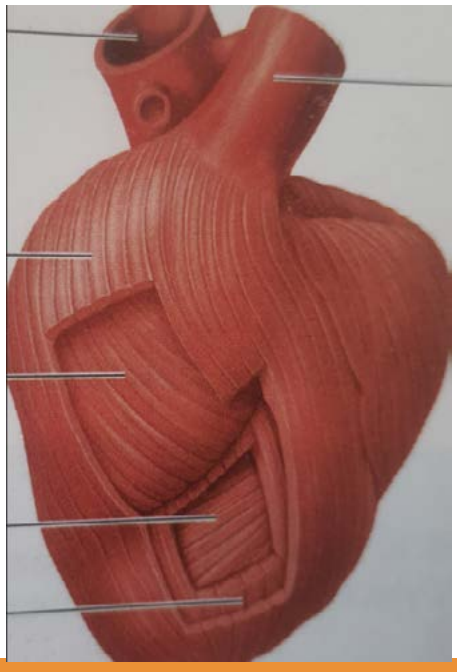
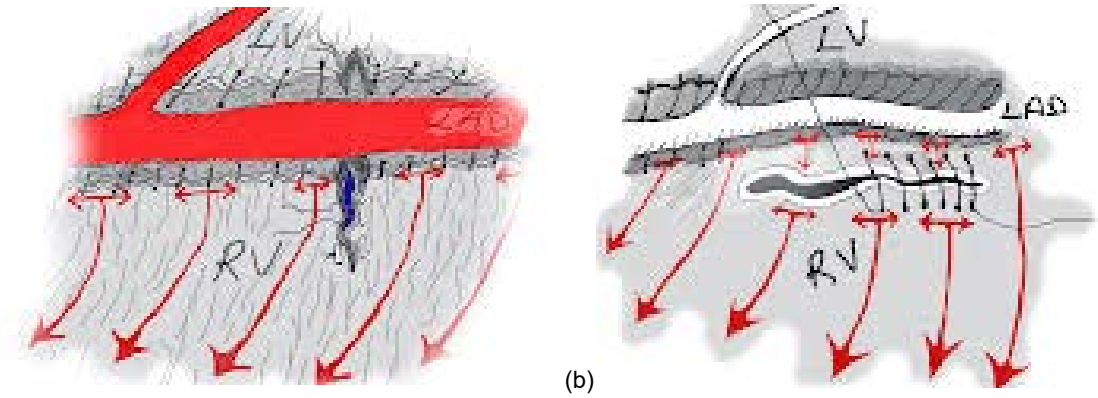


Figure 1: Myocardial fibers of the RV are perpendicular to the septum and LAD.

When the RVp incision that may occur during LAD exploration is perpendicular to the septum, the tensile force between the RV myocardial fibers will be minimal[6], whereas the tensile force is maximal with incisions parallel to the LAD/ septum. (Figure 2a and b). Our new surgical technique is based on this morphology and physiology of the RV myocardial fibers.



(a) (b)

Figure 2: (a) If the RVp incision is perpendicular to the LAD, the tensile force during contraction will be minimal. (b) If the incision is parallel to the LAD, it is subjected to significant tensile force.

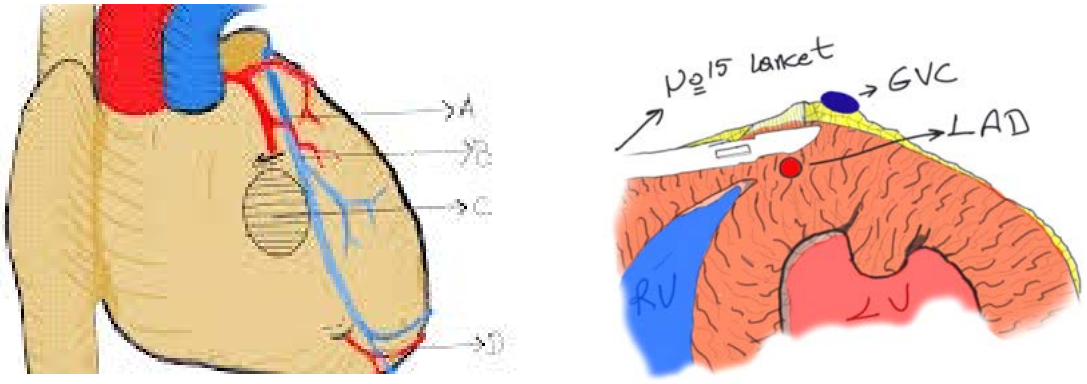
With this technique, the LAD is searched in a small area, the risk of damage to the LAD and anastomosis during repair of incisions is eliminated, and most importantly, if RVp occurs, the tensile force applied to the repair sutures is minimized because the incision is parallel to the RV myocardial fibers.

When the heart is in cardioplegic arrest, (all cases can be applied by providing arrest with standard sternotomy, on pump and antergrade/ redrogarde cardioplegia). The segment to be anastomosed is determined first. The segment can be better visualized by placing sponges under the heart. Care should be taken to ensure that the venous cannula completely decompresses the RV. Because a full and tense RV will make it difficult to apply the technique (Figure 3a).

In almost all cases, the LAD is located 1-1.5 cm to the right of the Grade Cardinal Vein (GCV). Although very rare, it may also be located on the left side[3]. In the segment where the anastomosis is to be performed, a very gentle and small incision of 1 cm in length perpendicular to the LAD axis is made on the right side of the GVC with a No. 15 scalpel (Figure 3 a and b).

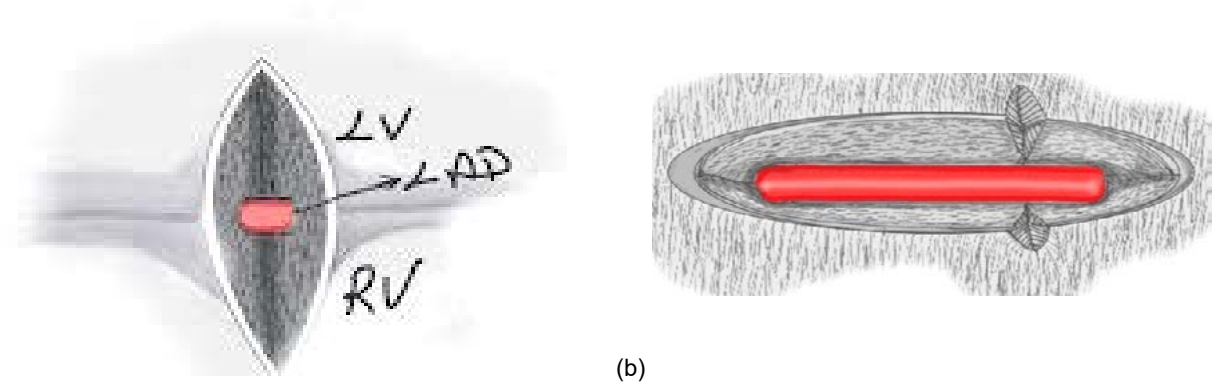
Each time we check whether the LAD is visible. If the GVC is not in the standard course, the space where the LAD will be located will be above the septum, so we locate the septum and make the incision over it. The most important problem here is intracavitary LAD course which is seen in 0.2%[3]

Since it is not possible to know preop how deep the LAD is, after each small incision, one goes deeper with minimal movements and very carefully. After a while, the LAD becomes obvious. The transfers incision is then discontinued and an incision is made over the LAD (Figure 4a and b).



(a) (b)

Figure 3a and b: We start to make a 1 cm long incision with a no:15 scalpel perpendicular to the GVC, probably in the segment where the LAD is located.



(a) (b)

Figure 4a and b: When the LAD is recognized by vertical incisions, the incisions are made over the LAD.

If there is a muscular bridge in the LAD and there is compression, a complete myectomy is performed on the LAD. In the absence of compression, the incision is extended as far proximally as necessary for the anastomosis and graft to travel at the appropriate angle.

When the LAD is suitable for anastomosis, suture marsupialization is performed with 6-0 Prolene (Ethicon, Somerville, NJ) and sometimes with a long strip patch made from the pericardium to prevent bleeding from the incisions. The LAD-LIMA anastomosis is performed later to prevent damage to the anastomosis.

If RVp is suspected, the RV is filled with venous cannula occlusion and checked for bleeding. RVp is the most important complication. For RVp repair, it is very important that the heart remains in arrest and the RV is empty. In the working heart, the risk of suture interruption and enlargement of the rupture increases.

RVp is repaired with 1 or 2 sutures with pledgite support. It is not necessary to compress the sutures too much. Because the epicardium is already facing and more importantly, the tensile force applied to the sutures is minimal and the systolic pressure in the RV is low. Because the RVp is perpendicular to the septum (Figure 5). In rare cases where the RVp incision is very close to the LAD, the LAD can be freed and sutures can be easily placed during repair as shown in the figure (Figure 5).

Not only the LAD but sometimes the obtus margin 1 (CX OM1) branch of the circumflex coronary artery may also be embedded in the myocardium. While the location where OM1 diverges from the Cx is relatively visible, determination of

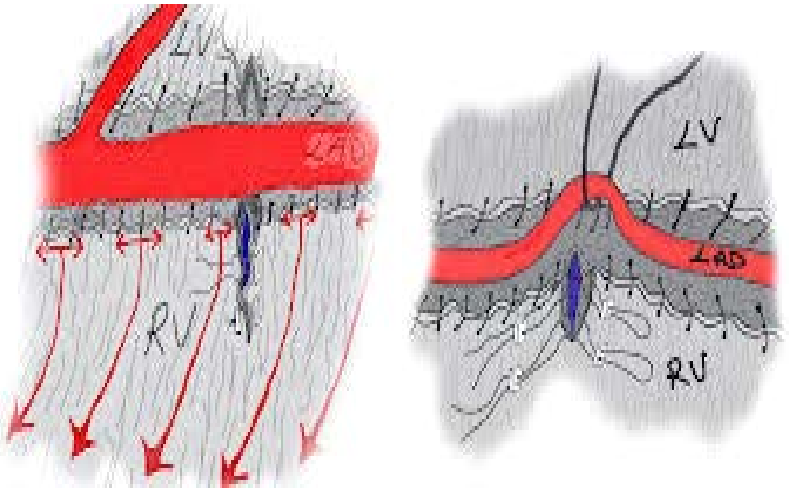


Figure 5: RVp incision is easily repaired with 6/0 propylene suture with pledgets.

the anastomotic site may be problematic. In this case, the width of the segment where the coronary artery is likely to be found is at most 1 cm. The possibility of finding this segment with incisions parallel to the coronary artery is very low. Because if the incision does not coincide exactly over the coronary artery; an unnecessary myocardial injury is caused.

In this case, it is easier to find the coronary artery with gentle incisions perpendicular to CxOM1. Of course, this time perpendicular incisions are made to the myocardial fibers in this region. However, since CX OM1 is not deep, these incisions are not deep either. Most of the time, bleeding stops without additional intervention. (Figure 6)

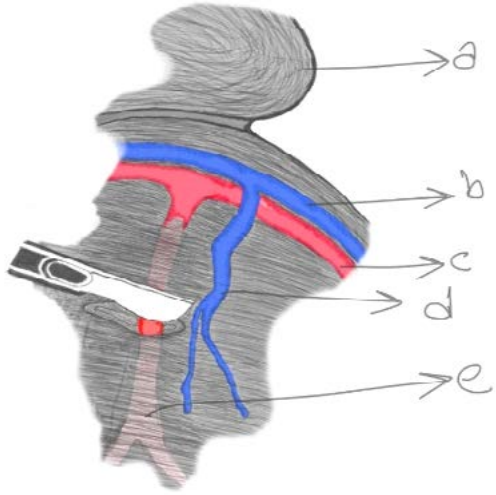


Figure 6: Finding the CX OM1 artery. a) left atrium appendage, b) cardiac vein. c) CX coronary artery, d) middle cardiac vein, CX obus margin OM1.

Discussion

Identifying the site of bypass of an embedded LAD is very important for coronary surgery and is an additional source of stress. If we consider LADs embedded in intramyocardial ones, epicardium and adipose tissue, this problem is a significant problem for many surgeons.

The value of creating an anastomosis from an atherosclerotic or small-diameter distal vessel to a larger-length, soft, non-atherosclerotic segment is obvious. Being able to do this both prolongs life and increases patients’ privacy by saving them from re-intervention. One of the most difficult parts of coronary artery bypass surgery is dissecting the deep-seated intramuscular LAD without causing any technical problems.All techniques for finding the LAD have their own advantages and disadvantages. The most feared complication is RVp. Because the incision is parallel to the septum, the repair sutures are subjected to great tension during contraction. Because RV myocardial fibers adhere perpendicular to the septum. During contraction of the myocardial fibers, the RVp is subjected to significant tensile force. Therefore, repair techniques involve the risk of damage to both the LAD and the anastomosis. In addition, during RV contraction, the repair sutures are also subjected to significant tensile force. For these reasons, sutures and repair may not be effective and may even rupture. In addition, there is a risk of damage to the LAD anastomosis or LAD septal branches.[1]

Some of the techniques require equipment and additional devices. Some require courage and experience. The frequently used method is to direct a 1 mm probe from the distal end of the LAD to the proximal; LAD also includes problems such as perforation, intimal damage and arteriotomy closure. To close the arteriotomy in the distal LAD, Apostolakis et al even developed a clever technique.[12]

All techniques described for RVp repair involve suture or patch closure of either the underside of the LAD to the opposite side or the right side and underside of the LAD. However, these have some serious physiologic obstacles.

Physiologic obstacles: RV myocardial fibers adhere perpendicularly to the septum (where the LAD courses). With each contraction, the short axis is stressed more than the long axis (Figure 2).

In the technique we describe: It is much easier to find the embedded LAD and if RVp occurs, according to the same physiologic rule, the tensile force applied to the sutures by myocardial contractions will be minimal because the incision is parallel to the myocardial fibers. More importantly, the repair will not have a negative effect on the LAD branches and anastomosis (Figures 1 and 3)

In CABG surgery, intramuscular LAD dissection should be performed when necessary to make a durable anastomosis with high patency to the most suitable segment of the LAD artery. For optimal anastomosis and minimal risk of complications, the functional anatomy of the heart related to its embryology, especially the Rv cardiomyocyte structure, should be taken into consideration.

References

1. VR Machiraju, DM Trivedi. Deep Intramuscular Left Anterior Descending (LAD) Artery: Implications for a Young Surgeon Performing Coronary Artery Bypass Surgery Clinics in Surgery. 2017, 2: 1-3.
2. EA vanker, NO Ajayi, L Lazarus, KS Satyapal. The intramyocardial left anterior descending artery: prevalence and surgical considerations in coronary artery bypass grafting**.** S Afr J Surg, 2014 Feb;52(1):18-21.
3. FRCS Vipin Zamvar,FRCS R.A.M. Lawson. Technique for finding the left anterior descending coronary artery. the Annals of thoracic Surgery Volume 60, Issue 5. November 1995, Pages 1457-145
4. E A Tovar, A.Borsari, D W Landa, P B Weinstein, A B Gazzaniga. Ventriculotomy repair during revascularization of intracavitary anterior descending coronary arteries. Ann Thorac Surg.1997 Oct;64(4):1194-6.)
5. Kaya Suzer, MD, Oguz Omay, MD, Emre Ozker, MD, Ilhan Ozgol, MD, and Theodor Stewens Wijers, MD A Novel Approach to Surgical Treatment of Diseased Intracavitary Coronary Arteries and Ventriculotomy Closure. Ann Thorac Surg 2008;85:1110-2)
6. Philip T. Levy, Aura Sanchez, Aliza Machefsky, Susan Fowler, Mark R. Holland, Gautam K. Singh A . Reference Ranges of Left Ventricular Strain Measures by Two-Dimensional Speckle-Tracking Echocardiography in Children: Systematic Review and Meta-Analysis. J Am Soc Echocardiogr 2016 Mar;29(3):209-225,
7. Ufuk Aydin, MD, and Cevdet Ugur Kocogullari, MD A Method for Locating Embedded Left Anterior Descending Coronary Arteries. Ann Thorac Surg 2013;95:360 -1
8. Mehmet C. Oz, MD, Matthew M. Cooper, MD, Thomas J. Hickey, PA, and Eric A. Rose, MD. Exposure of the Intramyocardial Left Anterior Descending Artery. Ann Thorae Surg 1994;58:1194-5
9. R L Fisk Surg. Locating the embedded anterior descending coronary artery: follow-up comment. Ann Thorac: 1996 Jul;62(1):319-20.
10. Robinson G. Location of the proximal left anterior descending coronary artery. Ann Thorac Surg 1973;15:299.
11. Belay Tesfamariam. Impact of Perivascular Adipose Tissue on Neointimal Formation Following Endovascular Placement. J Cardiovasc Transl Res. 2024 Aug;17(4):851-858.
12. Efstratios Apostolakis, M.D., Ph.D., Efstratios Koletsis, M.D., Ph.D., Vassilios Leivaditis, Vasilis Lozos, M.D., and Dimitrios Dougenis, M.D., Ph.D. A Safe Technique of Exposing of a “Hidden” Left Anterior Descending Artery. J Card Surg 2007;22:505-506.