

Original Article

Some Useful and Unusual Eponymous Cardiac Surgical Techniques Adopted in Chittagong Medical College Hospital

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Abstract:

Key Words :

Marine city
technique, Petlar
Stitch,
Tendolkar's
Maneuver,
Turkish Sling,
Pyongyang
Method, Cardiac
surgery,
Chittagong,

Background: Innovation is an integral part of cardiac surgery. A number of natural barriers had to be overcome by the cardiac surgery pioneers to establish open heart surgeries in the 1950s. Since then, surgeons are continuously developing and adopting various innovative techniques to ensure safety and efficacy of cardiac surgery. The Department of Cardiac Surgery of Chittagong Medical College Hospital (CMCH) has some unique characteristics as it was developed isolated from the centers of Dhaka. A few interesting methods are in practice here, which worth mentioning for the outside readers. Some of these procedures have been colloquially named in our department often after the visiting surgeon or the team who introduced those here.

Methods: The unique and unusual techniques applied in CMCH were sought and discussed. The hospital records, OT operation notes and ICU log books were thoroughly searched for any clue. The local and visiting team members were interviewed for any information. All available data were compiled and analyzed.

Results: Six interesting and useful named surgical techniques adopted in CMCH Cardiac Surgery Department were identified. These are: 1. Marine city ASD Closure Technique, 2. Tendolkar's Maneuver during CPB, 3. Turkish Sling in CABG, 4. Petlar Stitch in VSD closure, 5. Pyongyang Method of LA Closure and 6. NAK-NAKA De-calcification Procedure for valve surgery. The first two were introduced with the help of visiting Indian Professor Anil Tendolkar, whereas the 3rd was introduced by a visiting Turkish team. The 4th technique was adopted from a pediatric cardiac surgeon from Dhaka. The 5th and 6th techniques have long been in practice at NICVD, which were adopted with some modification in our department.

Conclusion: The above mentioned six reproducible techniques are unique and useful. Sharing and discussion of these techniques will enable other Bangladeshi surgeons to adopt these useful tips.

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Background:

Cardiac Surgery is relatively a young and new branch of medical science. Innovation remained an integral part of cardiac surgery since its inception. A number of natural barriers had to be overcome by John Gibbon, Walton Lillehei, John Lewis, John Kirklin and other cardiac surgery pioneers to establish open heart surgical procedures. Open heart operations only began in

the 1950s. Two American surgeons, John Lewis and Walton Lillehei, performed the first successful surgical repair of an atrial septal defect on 2nd September 1952 using hypothermia and inflow occlusion technique.¹ On 6th May 1953, Dr. John Heysham Gibbon, another American surgeon, used his own invented pump oxygenator (heart-lung machine) successfully to close atrial septal defect of an 18-year-old girl named Cecilia

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Bavolek.² This was the first ever use of cardiopulmonary bypass technique, the hallmark of heart surgery even today. Unfortunately, the next few patients operated by Gibbon didn't survive and he ultimately had given up cardiac surgery.¹ However, another famous American surgeon John Kirklin took interest in Gibbon's single operative achievement.³ Kirklin visited different groups working with mechanical pump-oxygenators including John Gibbon's group in Philadelphia. After these visits, he managed to persuade the management of the Mayo Clinic to let him build a pump-oxygenator similar to the Gibbon machine. His first case was a ventricular septal defect closure and was performed successfully with this new machine in March 1955. Four of the first eight patients operated by Kirklin and his team survived.⁴ Kirklin is thus often described as the first surgeon to perform a successful series of open-heart operations using the heart-lung machine. In 1954, Lillehei introduced another innovative technique known as the controlled cross circulation for open heart procedures. In this technique, a donor, usually one of the parents, had temporarily been connected his or her circulation to that of the small patient to take up the pumping and oxygenation functions of the patient who was being operated on. Lillehei and his team continued to use cross circulation for a total of 44 open heart operations in the following year, of which 32 patients survived.¹ Among these various innovative measures, only the heart lung machine survived as the ultimate device to support cardiac surgery. Other similar innovative techniques invented by the pioneer cardiac surgeons to support the circulation while the heart is kept arrested remain to be of historic interest only.

The term 'Eponymous' means 'of, relating to, or being the person or thing for whom or which something is named: of, relating to, or being an eponym'. Naming a surgical procedure depends upon a number of factors. Since those early days, surgeons are continuously developing and adopting various innovative techniques to ensure safety and efficacy of cardiac surgery. Often these techniques are named after the person or persons, who introduced the technique or played a major role in popularizing it. Some of the best examples of such named procedures are found in congenital

cardiac surgery. Several eponymous surgical procedures performed for congenital heart disease have been named after eminent surgeons.⁵ These procedures include Blalock-Taussig shunt, Potts shunt, Waterston shunt, Glenn shunt, Fontan Procedure, Norwood Procedure, Mustard procedure, Senning procedure, Ross procedure and so on. Adult cardiac surgery also presents names like Bentall's procedure, Cabrol's procedure, Batista procedure, Nick's technique, Konno's technique, Manouguian technique etc. At times, these are named after the institution or place in which those were developed. Such examples are Aberdeen knot or Barcelona procedure. Sayeba's method is an example of eponymous procedure in Bangladesh, denoting the treatment of post-partum hemorrhage with an inflated condom catheter inside the uterus popularized by renowned Bangladeshi gynecologist Prof. Sayeba Akhter and her team.⁶ She was awarded national award 'Ekushe Padak' for this feat.

Cardiac surgery in Bangladesh began in the 1980s after establishment of Institute of Cardiovascular Diseases (NICVD) on 4th June 1978.⁷ Bangladeshi cardiac surgeons were also traditionally involved with introduction and adoption of some unusual and useful techniques. The Japanese collaboration during the early days of cardiac surgery shaped a reliable and conservative surgical protocol in the then ICVD, which has been modified with time.³ Most of the Bangladeshi centers and surgeons in Bangladesh today follow that ICVD protocol with various degree of modifications. The Department of Cardiac Surgery of CMCH has some unique characteristics as it was developed in an isolated location far from the cluster of cardiac surgery centers at Dhaka. CMCH is the first public medical college hospital to start cardiac operations, even long before the public medical college hospitals of Dhaka. The 1st open heart surgery was performed in CMCH on 10th April 2012, whereas the cardiac surgery in DMCH and SSMC Mitford Hospital began much later, in 2019 and in 2021 respectively. This achievement denotes CMCH a rare feat where Chittagong has run ahead of Dhaka. Being developed far away from the establishment of Dhaka, the protocol used in CMCH is a little different. Since most of the pioneer cardiac surgeons of CMCH are trained in NICVD, the basic CMCH protocols mostly resemble NICVD.

However, some of the protocols have been innovated by the native surgeons or been influenced by the surgeons visiting during early days of the department. Famous Indian surgeon, academician and trainer Prof. Anil G Tendolkar, who is considered as 'Guru' by many Bangladeshi surgeons, made a couple of visits in 2012. A Turkish team of surgeons from Ankara Specialized Hospital visited CMCH in 2013. Expatriate Bangladeshi vascular surgeon Dr. Abidur Rahman along with an American pediatric cardiac surgeon Dr. Kim F Duncan visited CMCH Dept of Cardiac Surgery in 2014. All these early visitors left some imprints on the protocol adopted. A few of these interesting methods practiced in Chittagong Medical College Hospital are mentioned here.

1. Marine City ASD Closure Technique:

Marine City ASD Closure Technique is an easy surgical technique for pericardiac patch closure of Atrial Septal defect. This technique requires very little assistance, so easy for the surgeons to perform. This technique was first demonstrated by famous Indian cardiac surgeon Prof. Anil G Tendolkar while he visited CMCH in the early days of the center. This technique was quickly adopted by our surgeons and has become the regular mode. Initially called Bombay-Chittagong technique to remember Prof. Tendolkar's contribution, it is later called Marine City Technique as both the cities, i.e. Prof. Tendolkar's Bombay (or Mumbai) and Chittagong are seaside cities or marine cities.

In this technique, after standard sternotomy, establishment of CPB and getting cardioplegic arrest of the heart, right atrium is opened with an incision 1 cm away and parallel to the AV groove. Following inspection of openings of the pulmonary veins, coronary sinus and mitral valve, the ASD closure is done. The parietal pericardium on the left side of the pericardiotomy incision is laid with a 3/0 silk traction stitch. ASD closing suture is started from near the lower margin of the pericardial edge. With a 4/0 double ended Polypropylene suture material and 16 mm round body needles at both ends, the surgeon starts taking fore hand stitches from the rough outer surface of the pericardium in and then from the left atrial aspect to the right atrial aspect out at the lower right corner of the ASD. The stitch is

continued in the same fashion cranially along the right border of the ASD. As the pericardium is spread by the traction stitch, the surgeon may continue stiches with a little or virtually no support from the assistants. Upon reaching the upper end of the right margin, the surgeon stops and continue with the other end of the double ended polypropylene suture. Now the stiches are taken forehand entering from the right atrial side of the ASD edge and continuing out from the left atrial side and then passing through the pericardium from inside out i.e. from the smooth lower side to the rough upper side. Stiches are continued along the lower edge towards the left edge of the ASD. Care is taken to cover the floor of LA and not to damage the coronary sinus. The suspended pericardium is then cut and fashioned to make a perfect match covering the ASD hole. The suture is continued along the left edge to the top and after de-airation, both ends are tied together to complete the surgical closure of the ASD.

2. Tendolkar's Maneuver (Low Freq Low TV):

Tendolkar's Maneuver (Low Freq Low TV) is another technique introduced in CMCH by Prof. Tendolkar. The deflated lungs are the major source of inflammatory mediators released during Cardiopulmonary bypass (CPB). In Tendolkar's maneuver, the lungs are not completely deflated after the cross clamp is applied. Rather, the anesthesia machine is kept operating in a low volume low frequency mode. A tidal volume of 2 to 3 ml/ kg body weight is continued at a rate of 5 to 6 cycles/min. This prevents the complete collapse of the lungs and thereby at least theoretically reduces the release of inflammatory mediators and other complications of immobile deflated lungs. Keeping ventilation on enhances interrupted pulmonary venous return giving surgeons some troubles at time. In such times, the ventilation may be momentarily stopped to help the surgeons.

Although there hasn't been any ideal comparative study done, our observation is that Tendolkar's maneuver is useful in reducing inflammatory response to CPB, collapse of lungs and other associated complications. Some studies demonstrated that continued low tidal volume

ventilation during CPB improved post-bypass oxygenation and lung mechanics,⁸ whereas some others did not.⁹

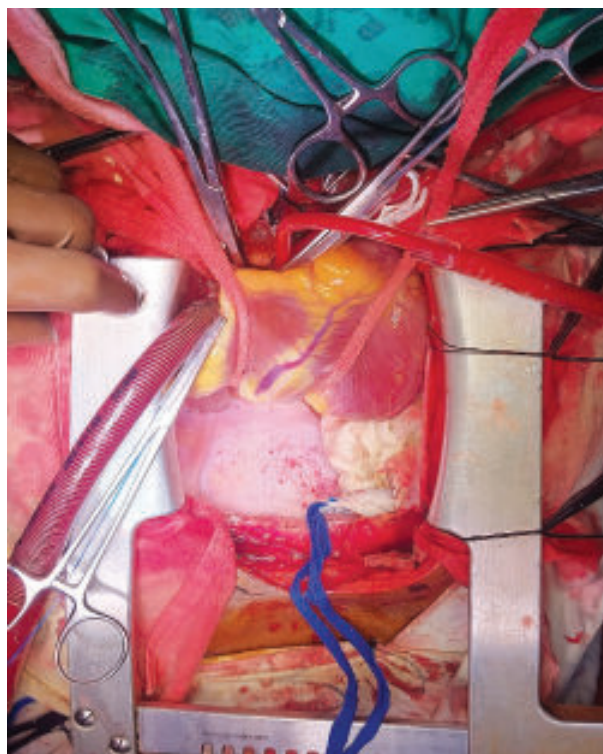


Figure 1. *The Turkish slings are used for positioning the heart elevated to expose the diaphragmatic surface for distal anastomosis of PDA*

3. Turkish sling in CABG:

In On pump CABG, mobilization and positioning of the arrested heart during grafting is an important step. Turkish sling technique is a simple and effective technique for positioning the heart during distal anastomosis. This technique was demonstrated by a visiting Turkish cardiac surgery team and is adopted by the surgeons of Chittagong Medical College. In this technique after median sternotomy, graft harvesting is done accordingly, CPB is established and then one long sling of surgical gauze of about 60 cm length is passed behind the Aorta and Pulmonary trunk through the transverse sinuses. Another sling is passed behind the inferior vena cava (IVC) as like IVC taping. These slings are used for positioning the heart during distal anastomosis (Fig 1).

After cardioplegic arrest of heart during distal anastomosis of RCA or PDA, the sling encircling

the IVC is used to position the heart. The two ends of the sling are moved towards the neck to positioning the heart upward and then fix the sling to the draping sheet with the Kocker's forceps for maintaining the position of heart. During anastomosis of OM graft left ends of the two slings are used to position the heart upward and to the right. By these ways, Turkish sling technique helps the surgeon to put the heart in various positions. This technique replaces the manual retraction of heart during distal anastomosis and hence easier the procedure.

4. Petlar stitch in VSD closure:

This technique is used in VSD closure. In VSD closure, especially in perimembranous type, proper visualization of the VSD and its margin is sometimes troublesome due to the presence of septal leaflet of tricuspid valve and its chordae. To facilitate proper visualization a traction stitch with 4/0 polypropylene suture is placed in the septal leaflet of tricuspid valve to retract the leaflet towards the right of the surgeon. This technique was adopted from a pediatric cardiac surgeon during his brief stay in CMCH in 2016. The suture should pass along the junction of the cusp with annulus. Placement of this stitch deep into the annulus may harm the conductive tissues, whereas its placement in the cusp may result in cusp injury. The retraction helps the surgeon to visualize the VSD and its margin properly. This simple technique facilitates easy and complete closure of VSD. On completion of VSD closure, this stitch is removed.

5. Pyongyang method of LA closure:

Left atriotomy (LAotomy) is done in various cardiac surgical procedures, most commonly in mitral valve replacement and excision of left atrial myxoma. In CMCH, a peculiar method is in practice for LA closure, which has been adopted from NICVD. In this method, a sump vent catheter is placed in the left ventricle and left atrium through the LAotomy suture line (Fig. 2A). Left atrium is closed in two layers keeping the vent in situ, which then attach to a cardiotomy sucker. Two layers of polypropylene sutures are placed around the catheter in the most peculiar manner (Fig 2B). Because of the peculiarity of this method, we call it 'Pyongyang method' as it reminded some of the peculiar decisions carried out

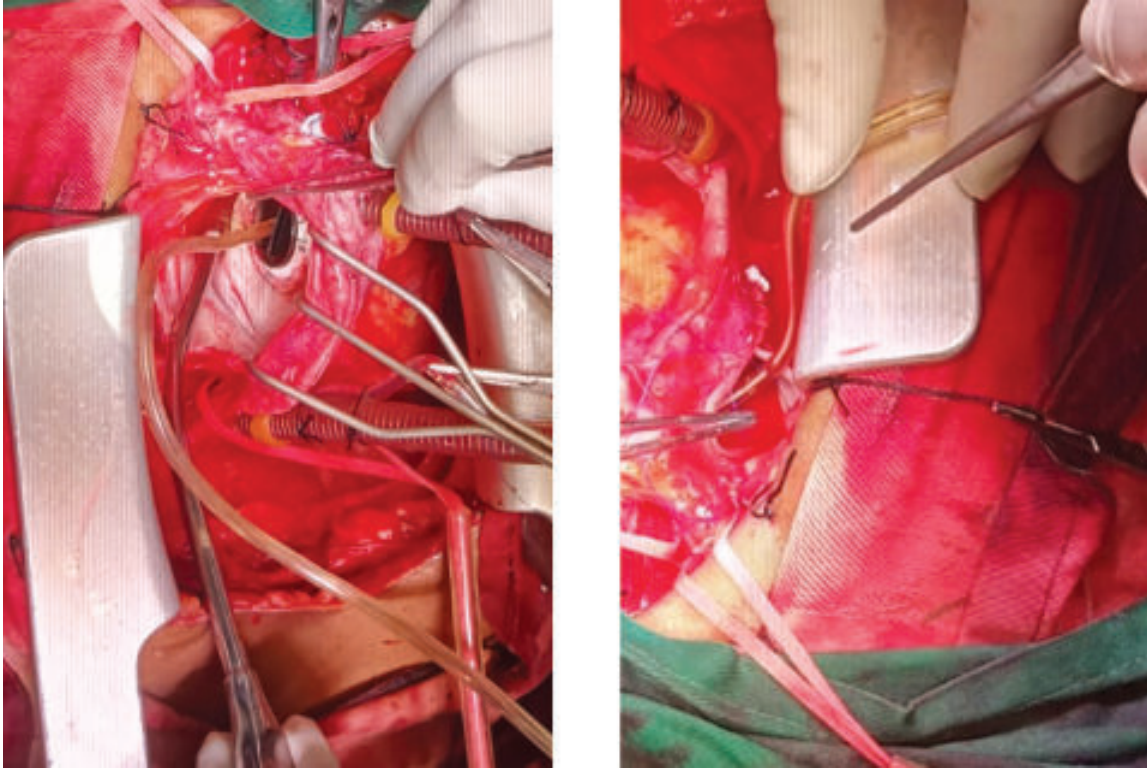


Figure 2: (A) A vent catheter is passed via LAotomy incision and implanted prosthetic valve into left ventricle. (B). LAotomy is closed with sutures placed in a peculiar manner around the vent catheter (Pyongyang method).

by the authoritarian regime of North Korea. In 2016, a 66-year-old general was purged and blown away with anti-aircraft gunfire for falling asleep during a meeting with their leader.¹⁰ The method was named after this peculiar and inhuman incident. The sump vent helps to removal of air from the left heart chambers and prevents dilation of left ventricle. Additional venting is also done through cardioplegic cannula. During weaning from CPB when the heart activity is regained this LV vent is removed. This technique satisfactorily removes air from left heart during weaning from CPB and also prevents distension of left heart. The easy way of putting this sump catheter is introducing separately via the right superior pulmonary vein away from the LAotomy incision allowing complete closure of the left atrium. In contrast to The Pyongyang method, we often jokingly call this 'The Seoul method'!

6. NAK-NAKA procedure for decalcification of valve annulus:

Severe calcification is a common finding in Bangladeshi patients undergoing valvular

replacement, be it mitral or aortic. Most patients are referred to the surgeons quite late. By then, severe calcification usually involves valve cusps and annulus putting the surgeon in a difficult position. A peculiar, but effective method adopted from NICVD is commonly used at CMCH to clear the calcified materials from valve annulus or the adjacent tissue. A stout jawed Kelly's forceps is employed to crush the calcium stones between its jaws. The calcified areas are held between the forceps jaws and crushed by repeated opening and closure of the jaws. The calcified areas are thus decalcified partially or in toto. If carefully applied, this method is useful and helps to clear stony hard calcium stones for easy placement of valve sutures. This maneuver was practiced by pioneer Bangladeshi cardiac surgeon Prof. M Nabi Alam Khan and his favorite disciple famous surgeon Prof. N A Kamrul Ahsan. The name 'NAK-NAKA procedure' came as from 'Nabi Alam Khan- N A Kamrul Ahsan procedure'. The procedure involves some risk of damaging the annulus or conductive tissues. However, it has been applied to more than 30 patients of aortic and mitral valvular

replacement in CMCH without any serious complication.

Conclusion:

Six unusual, but useful procedures have been discussed here. These procedures are commonly practiced in CMCH. Some of these procedures are unique in Bangladesh, whereas a few others are practiced also in other Bangladeshi centers in a different format. However, all these techniques are very effective, useful and reproducible for other centers. We have frequently used these procedures with safety and success. We also have provided some sweet nomenclatures for these procedures. These techniques have been shared here in details, so that these could be adopted by the others.

Conflict of Interest - None.

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