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Cardiac surgery has been the last of the surgical specialties to embrace the principles of minimal invasiveness. The complexity and invasiveness of the procedures have presented both a problem and an opportunity to make the procedures less invasive. Beginning with initial attempts at coronary artery bypass surgery through limited access, a number of other cardiac procedures currently are being performed by minimally invasive approaches. These include mitral valve repair, transapical aortic valve implant, limited access, and totally endoscopic pulmonary vein isolation for the treatment of atrial fibrillation, the treatment of aortic aneurismal disease by thoracic endografting and Hybrid Procedures. The experience with less invasive surgery in other specialties has served as cross-fertilization for minimally invasive cardiac surgery.

Minimally Invasive Cardiac Surgery (MICS) & Hybrid Surgery

Background

Cardiac surgery is now more than a century old. The first successful surgery of the heart, performed without any complications, was by Dr. Ludwig Rehn of Frankfurt, Germany, who repaired a stab wound to the right ventricle on September 7, 1896. Invention of heartlung machine in 1953 opened all new horizons in cardiac surgery. Standard heart surgery typically requires exposure of the heart and its vessels through median sternotomy (dividing the breastbone), considered one of the most invasive and traumatic aspects of open-chest surgery. Pain due to rib fractures, atalectasis, more ICU and hospital stay are key disadvantages of this big incision. Considering all these, multiple alternative access incisions have been described and used for various procedures in cardiac surgeries and published as Minimally Invasive Cardiac Surgery (MICS).



Minimally Invasive Cardiac Surgery (MICS)

Minimally Invasive Heart Surgery (also called keyhole surgery) is performed through small incisions, using specialized surgical instruments. The incision used for minimally invasive heart surgery is about 2 to 3 inches instead of the 8 to 10 inches incision required for traditional surgery. The spectrum of MICS includes all types of valve surgeries, ASD Closure, coronary artery bypass grafting and hybrid procedures. The approach to the heart is through minimsternotomy or small

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thoracotomy, using THOREXPO retractor arc, blade guide, manubrium hook, coupling rider system, OR-Table adapting clamp.

MICS Procedures

MICS ASD closure is one of the most common procedure performed through small incisions. ASD can be closed through small Ant.Thoracotomy, subxiphoid incision or small partial lower sternotomy.

Valve surgeries, including valve repairs and valve replacements, are the most common type of minimally invasive surgery, accounting for 40 percent of all minimally invasive cardiac surgeries performed at our center.



Minimally invasive direct coronary artery bypass graft (MIDCABG) surgery is an option for some patients who require a left internal mammary artery bypass graft to the left anterior descending artery.

Hybrid procedures are combination of surgical and catheter-based intervention to the heart. Hybrid coronary artery revascularization is a combination of surgical and catheter-based intervention to the diseased coronary arteries.

MICS-Patient Selection

Patient selection is very important as only the desired part of the heart can be approached through these small incisions; so presence of associated pathology makes this surgery impossible. For example, co existing coronary artery diseases in valvular lesions. Peripheral vascular system has to be normal as femoral vessels are required to put the patient on heart lung bypass.



MICS - Advantages

The benefits of minimally invasive surgery techniques are due to small incisions and scars. There is less incidence of infection, bleeding and blood transfusions. Less invasive procedure and less pain make hospital stay shorter than routine cardiac surgeries. Faster recovery leads to early resumption of day to day activities. The average recovery time after minimally invasive surgery is 1 to 4 weeks, while the average recovery time after traditional heart surgery is 6 to 8 weeks. These incisions are better cosmetically and also known as bikini scar.

Limitations of MICS

Certainly, MICS requires definite learning curve. The duration and techniques of anesthesia and surgery can be prolonged due to technical difficulty, and the risk of unsatisfactory anastomosis or incomplete revascularization can also be increased. The cardiopulmonary bypass circuit utilized for MICS requires a more complicated system including negative pressure venous drainage. The detection of accidental trouble during surgery, which is related to the extracorporeal circulation or the MICS procedure itself, can be delayed due to the limited surgical view. MICS procedures carry additional risks related to the more complicated cardiopulmonary bypass system and small surgical wound. We must be deliberate in determining the indications for MICS and obtain complete informed consent from patients when we perform MICS, including informing them of the additional risks related to the MICS procedure itself and the possibility of conversion to standard open-heart surgery.

Instrument fulcrum movements become limited in presence of small and rigid intercostals space and bidimensional vision; finally causes more operator fatigue.



IS MICS For all - NO

MICS is truly subject of preference for both; surgeon and patient. Presence of multiple pathology and gross peripheral vascular disease make this procedure impossible. Occasionally, small thoracotomy exposure is difficult in grossly obese patients.

Hybrid Procedure

The Hybrid procedure is an innovative approach to double- or triple-vessel coronary artery disease. The hybrid approach combines minimally invasive coronary artery bypass surgery with catheter-based coronary intervention (PTCA, stenting). The rationale for this approach is that the internal mammary artery, which can be placed in minimally invasive fashion, is the best choice for the anterior wall of the heart. Under protection of this bypass graft, the other vessels are stented. The hybrid procedure combines the best of both worlds - bypass surgery and stenting -- by using a minimally invasive surgical procedure that has longevity and using stents for what they are best at, which is taking care of non-left anterior descending (LAD) vessels. These approach benefits patients because it is more convenient and less stressful to have both bypass surgery and stenting performed at the same time, rather than on separate days.

The procedure is carried out with the complete safety net of a cardiac surgery operating room. Another advantage for patients is that this type of bypass surgery can be performed without a major incision. It's a less invasive procedure with improved chances for long-term success. Patients can also expect quicker recovery times and reduced hospital stays.

Ideal candidates for the hybrid procedure have a blockage in a major vessel called the left anterior

Hybrid CABG



1st stage MICS CABG showing patent LIMA to LAD graft



2nd Stage RCA Plasty



descending (LAD) artery, which supplies 60 percent of the blood to the heart, as well as blockages in non-LAD arteries that can be treated with a stent.

MICS-Future

Minimally invasive cardiac surgery continues to evolve and expand with growths in technology and surgeon experience. Now that a significant amount of data has emerged on the safety and efficacy of MICS across a range of surgical operations, there is evidence to support the widespread adaptation of such techniques. In the future, there will likely be a greater request for MICS approaches by patients seeking cardiac surgical options with reduced surgical trauma that allow for a faster return to normal activities and improved quality of life. In addition, MICS itself will continue to evolve in the future through growing use of percutaneous technology, hybrid operating rooms and ongoing collaborations with interventional cardiologists.





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