*ejpmr, 2016,3(6), 588-593*

SJIF Impact Factor 4.161

**EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH**

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

# RIGHT ANTEROLATERAL THORACOTOMY FOR OPEN-HEART SURGERY, HOW TO DO A SAFE APPROACH

**Walid AE Hammad*[1] and Sherif Eliwa[2]**

[1]Cardiothoracic Surgery Department, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.
[2]Prince Sultan Cardiac Center, Hasa, KSA.

***Corresponding Author: Walid AE Hammad**

Cardiothoracic Surgery Department, Faculty of Medicine, Al-Azhar University, Cairo, Egypt.

**Article Received on 01/05/2016** **Article Revised on 17/05/2016** **Article Accepted on 01/06/2016**

## INTRODUCTION

Median sternotomy has been the conventional approach for performing open cardiac surgeries for many years, but it often yields poor cosmetic results. Unsightly midline scars arouse displeasure and psychological distress, especially in young female patients **(1&2).** Even if with the introduction of the ministernotomies, presence of a longitudinal scar still undesirable. The right anterolateral thoracotomy (RALT) has been advocated for many years and has been used as an alternative to ministernotomy, particularly in female patients. The RALT has gained great popularity over the past few years in patients with congenital and acquired heart disease because of the combination of good aesthetic and functional results. The superiority of this approach in adult female patients is clear focusing on patient satisfaction with the cosmetic and functional results in terms of minimal respiratory compromise and late breast development **(1&3).**

## AIM OF THE WORK

The primary purpose of this study is to describe a safe RALT approach for performing the cardiac procedure based on good exposure. With spot lights on proper patient selection and alternative plans in case of poor exposure.

## METHODOLOGY

Between December 2014 and January 2017, nineteen patients aged 12 to 41 years with mean age 29 years underwent open heart surgery through RALT approach in El-Hussein University hospital, Cairo. There were 16 female and 3 males. There were deferent cardiac pathologies including congenital and acquired valvular heart diseases. The initial selection of the patient was performed to insure a good exposure and safe procedure **(Table 1).**

All patients were positioned supine with the right side of the body elevated 45° and the right arm padded and suspended over the head. the site of skin incision going through the breast crease in females or pectoral major fold in males was marked before patient draping with marking of the important anatomical land marks for proper orientation (i.e xiphoid process, angle of Lowis, rib marking, and the site for crossing the sternum) in case of Clamshell incision was needed (Fig. 1).

A semilunar skin incision in the sulcus of the right breast (above the 6$^{th}$ intercostal space) was done in all female patients **(Fig 1)** with particular care was necessary in prepubescent girls, in whom the incision was kept approximately 4 to 6 cm below the right nipple and extended it to the posterior axillary line to avoid any possible future interference with breast development. In males, the incision was carried out through the pectoralis major fold opposite the 5$^{th}$ intercostal space. Raising the pectorals major muscle at the level of the 6$^{th}$ rib away from the chest wall with the overlying breast tissue is mandatory.

After creating a good pecto-mammary flap **(Fig 2A&B)**, we enter the chest through the 4$^{th}$ intercostal space. If access as still inadequate, the 4th costal cartilage was cut and retracted superiorly. Instead of that, entering the chest through the bed of the 4$^{th}$ rib after subperiosteal exiscion was our choice in most patients **(Fig 2C&D).** This is a vital step to facilitate ascending aorta cannulations and cardioplegia insertion.

The thoracic cavity was exposed by means of a rib retractor. A large blade rib retractor has been routinely used for enhancing chest retraction with consequent better visualization of the aorta (which represents, in our opinion, the only critical point in this type of approach), enhancing the safety of the operation.

Collapsing the right lung with a wet large swab would improve the exposure of the pericardium. Opening the pericardium with longitudinal incision, 2cm above and parallel to the phrenic nerve with an L-shaped extension leading to the cardiac apex were mandatory. Traction on the pericardial stay suture with proper positioning is *important* to pull the heart towards the right side and

improve the exposure. In addition, suturing the uppermost pericardial sutures to the adjacent chest wall is important to facilitate AA exposure and cannulation.

After systemic heparinization, the strategy for burse string and cannulation was as follow **(Figure 3):**

1- Burse string the right atrial appendage and pull it down to expose the aortic root and ascending aorta (AA)
2- Burse string the site of cardioplagia cannula to pull the AA down and fix it during cannulation
3- Double bursting the site of AA cannulation and cannulate the aorta with Femflex II femoral arterial cannula with Duraflo coating (Edward Lifesciences, Irving, CA). In 5 cases (%) because of short aorta, right femoral arterial canulation was done By surgical isolation and cannulation of the femoral vessels (using the Seldinger technique or transverse arteriotomy) through a 2 to 3 cm longitudinal incision at the groin
4- Insert the cardioplegia cauula
5- Burse string and cannulate the IVC with an angled Medtronic DPL cannula (Medtronic, Inc), which is usually passed through the thoracotomy wound
6- Commencing the CPB with single venous canula will facilitate canulation of the SVC through right atrial appendage with no haemodynamic affection.
7- Cannulation of the superior vena cava was then achieved through the right atrial appendage using a straight cannula, Femflex II femoral venous cannula with Duraflo coating (Edward Lifesciences) or Medtronic DPL cannula (Medtronic, Inc, Minneapolis, MN).
8- Snaring around the venae cavae

Using this approach surgeries for ASDs closure, isolated mitral valve, combined mitral and tricuspid and isolated aortic valve surgery were applicable **(Table 1) & (Figure 4).**

After completion of the cardiac procedure, adequate hemostasis of all the parities and suture lines, insertion of right angled chest drain situated at the diaphragmatic surface of the heart and a straight drain into the dependent part of the right pleura. Two pacemaker wires are inserted (if needed) at the RV. Closure of the intercostal space with three or four 8-shape vicryle 2 or 3 sutures followed by Reinsertion of the pecto-mammary flap to the fascia and origin of external oblique muscle are mandatory. Closure of the subcutaneous tissue in one layer with vicryle 0 followed by skin closure. It is important remove the mediastinal drain once the drainage stop (below 80 ml in last 12 hours) while the pleura drain stay in place for a couple of days to drain any seroma below the mammary bed.

## RESULTS

In our study of undergoing open-heart Surgery for 16 patients via a right anterolateral thoracotomy, there was no complication or mortality directly related to the incision type. Smooth cannulation and satisfactory intracardiac exposure were achieved in all patients. The duration of aortic cross-clamping ranged from 18 to 99 minutes (mean, 42.9 ± 26 [SD] minutes) and the duration of cardiopulmonary bypass ranged from 34 to 124 minutes (67.1 ± 29.9 minutes). All our Patients were weaned from mechanical ventilation support after a mean period of 4.2 ± 4.4 hours. The mean blood transfusion volume was 279 ± 246 mL and the mean pleural drainage was 238 ± 104 mL. The postoperative hospital stay ranged from 3 to 15 days (7.2 ± 2.5 days). The mean follow up ranged from 14 to 480 days; all patients were found to have no symptoms of note. One patient died 8 months after mitral valve replacement with prosthetic bileaflet valve due to intracranial hemorrhage as a result from maladjusted warfarin dose.

The incisional lengths ranged from 8 to 16 cm (11.2 ± 3.0 cm) and 3 patients had mild incisional scar formation. The incision was hidden below the axilla and the mammary groove and postoperative scar formation was less noticeable because the incision line was parallel to a skin fold **(Fig. 5)**. The patients experienced less injury and blood loss, no need for stainless steel closure of the incision, less postoperative pain, quick recovery, no external deformity and a lower risk of infection than they might have had with a sternotomy.

**Figure 1.**

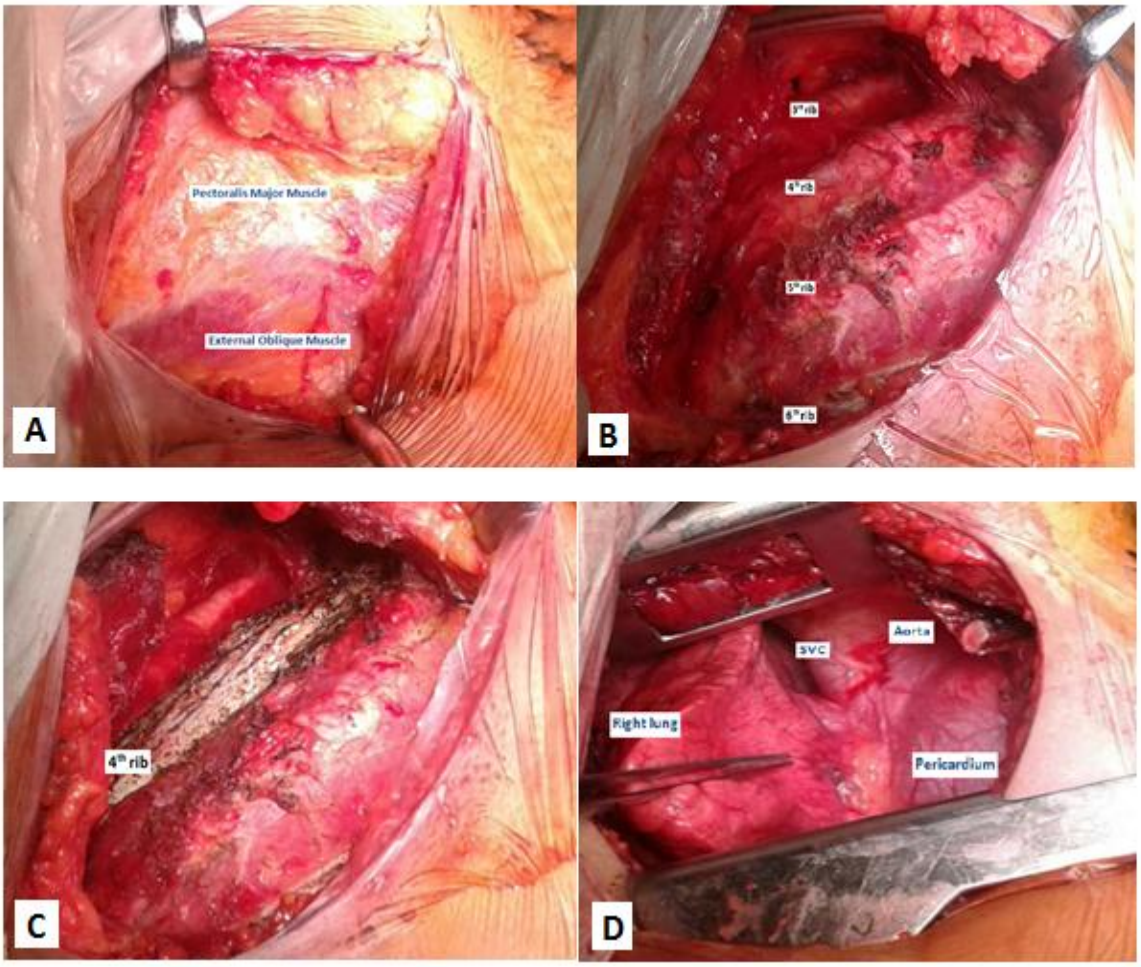


**Figure 2;**

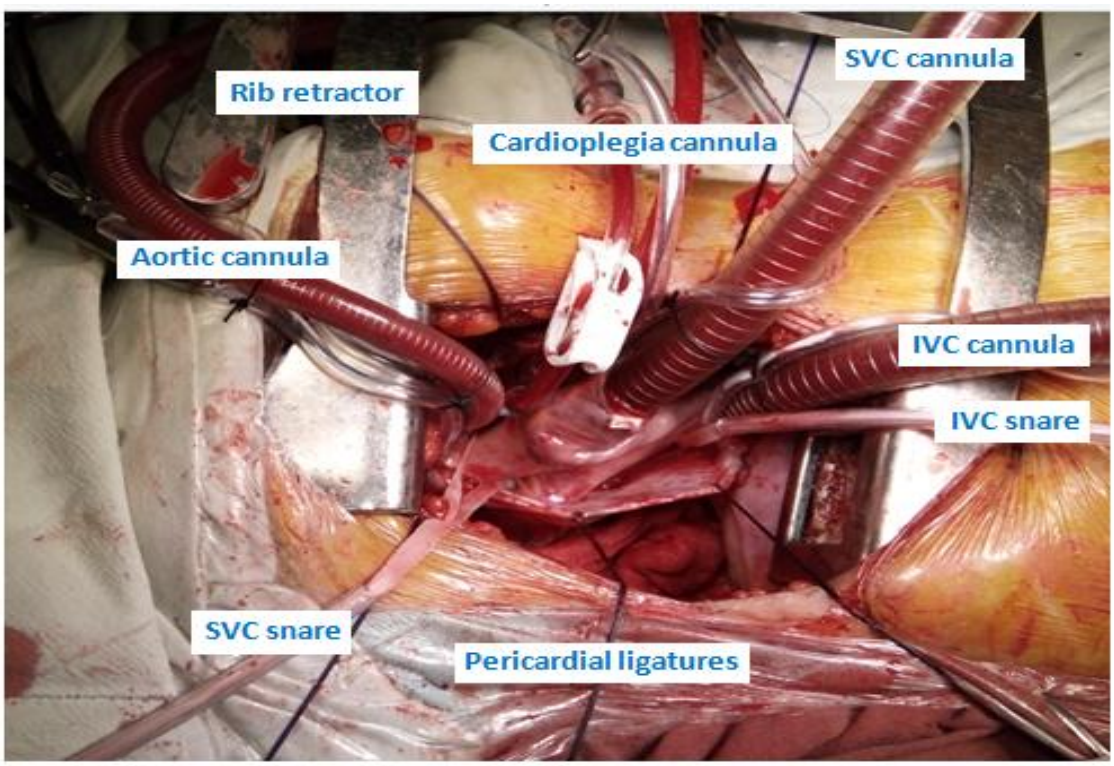


**Figure 3;**

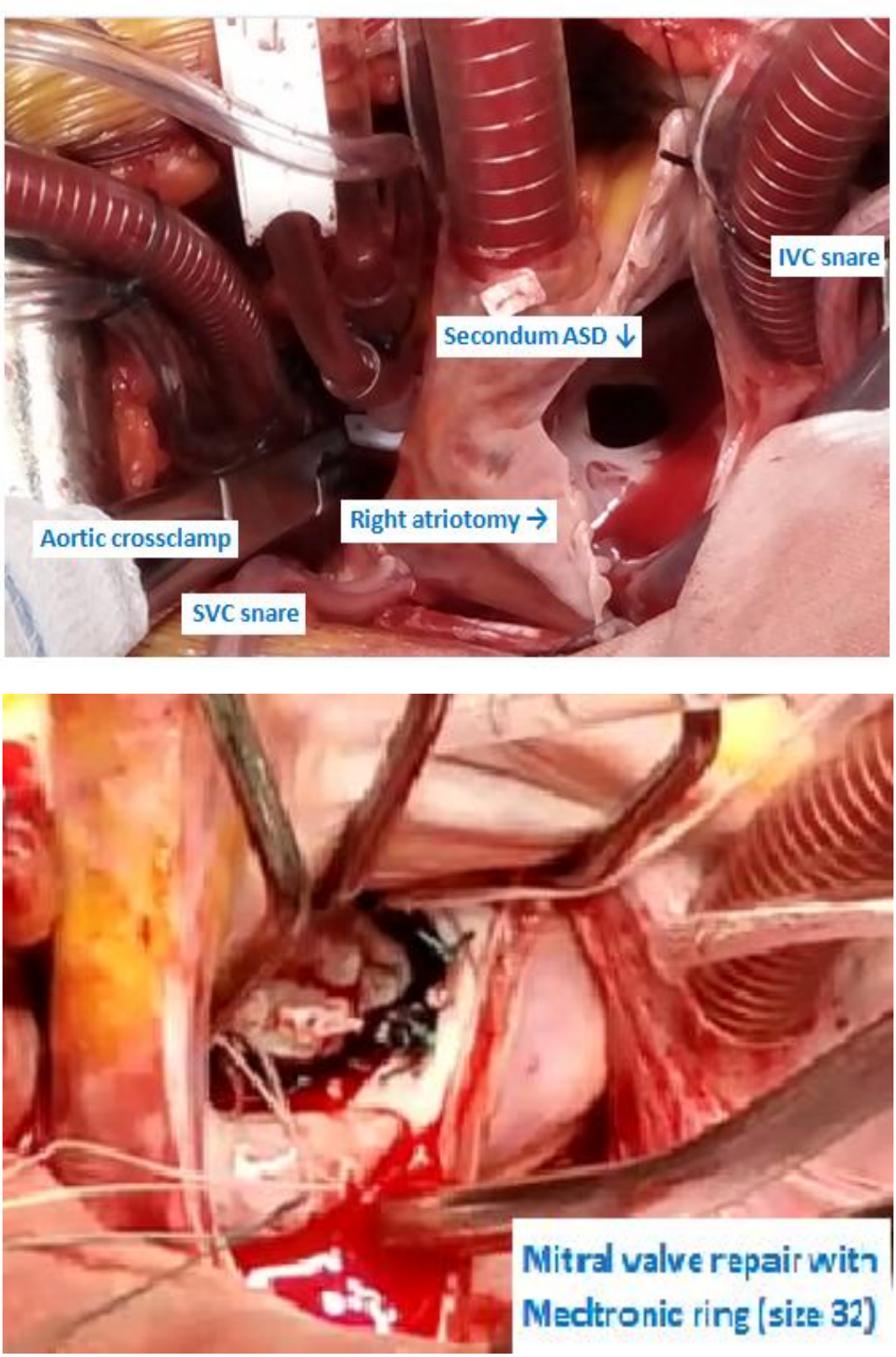
IVC snare
Secondum ASD ↓
Right atriotomy →
Aortic crossclamp
SVC snare
Mitral valve repair with
Medtronic ring (size 32)

**Figure 4;**

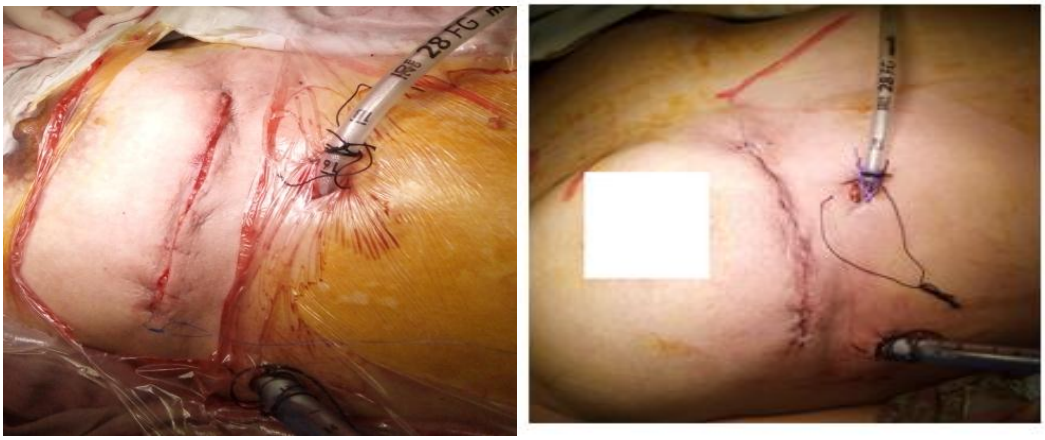

**Figure 5;**

**Table 1.**

| Cardiac procedure | Number of patients Total (19 pts) | approach |
|---|---|---|
| ASD (secondum) | 5 | Right atriotomy |
| ASD (premium) | 3 | Right atriotomy |
| MVR | 6 | Standard left atriotomy |
| MVR + TV repair | 3 | Standard left atriotomy+ Right atriotomy (2)<br>Biatrial approach (3) |
| AVR | 2 | Oblique aortotomy |

**DISCUSSION**

Most of our patients were females, as better cosmetic appearance is more noticeable in females with well-developed breast. Although the superiority of this approach is clear in adult female patients, few data in the medical literature had shown altered breast development in the prepubescent patient. **Bleiziffer and colleagues** reported impaired breast development in female patients after RALT, in which a partial transection of large muscle groups was used. As a consequence, they proposed to abandon this technique in favor of other minimally invasive approaches such as the right mid axillary thoracotomy **(4).** In other study by **Cherup"' and colleagues** reported bilateral asymmetrical breast and pectoral development or even an impact on breast-feeding due to postoperative paresthesia. These problems were attributed to damaged areolar bud tissue, devascularization of the breast and pectoralis major, and denervation of the pectoral muscle when it was divided **(3).** Therefore, the skin incision for the anterolateral thoracotomy should circumvent the areolar tissue in order to avoid injury to breast bud tissue. A small slanted incision may impart less injury to nerves and damage of vessels to the pectoralis major. In our technique, the undermining we did through the breast bed by elevating the right pectorals major muscle away from the anterior chest wall and entering the chest through 4$^{th}$ intercostal space was developed to avoid any possible interference with the blood supply to the breast tissue.

Precautionary measures must be taken to prevent phrenic nerve damage **as Vida VL and coworkers** reported a significant incidence of phrenic nerve damage in a group of older children undergoing right thoracotomy for closure of atrial septal defects **(2).** Possible causes of phrenic nerve damage include unclear visualization of the nerve posterior to the thymus, dissection, electrocauterization, or traction on the nerve during pericardial retraction. The surgeon must be aware of the course of the phrenic nerve on the pericardial surface in order to avoid damaging the nerve during the pericardiotomy or during electrocauterization for bleeding. Another precautionary measure is to avoid over-stretching of the pericardial edges.

Exposure of the ascending aorta during RALT necessitates a deep incision; consequently, cannulation and cross-clamping are difficult and can complicate the institution of cardiopulmonary bypass and myocardial protection. So, it is very important for the surgeon to proper counting and marking the right thoracic cage to insure entry of the chest at the level of the 4th intercostal space. If access as still inadequate, the 4th costal cartilage was cut and retracted superiorly**.** To avoid abnormal cerebral perfusion and inadvertent withdrawal of the cannula, we used deep placement of Femflex II femoral arterial cannula with Duraflo coating (Edward Lifesciences, Irving, CA), With this method, it is not difficult to judge whether the cannula has accidentally entered the carotid artery or subclavian artery: one can observe the pulse wave form, ask the anesthesiologist to palpate the bilateral carotid artery, or rely on the operator's perception of a difficult entry. Transesophageal echocardiography can be used to ascertain correct positioning of an aortic cannula.

Because of relatively poor exposure of the left ventricle and the great vessels in the cardiac basis, in agreement

with **Wang YQ and his colleagues (5),** RALT is not suitable for some patients, either because of the expected inadequate exposure or difficulty of insuring total repair.

Those have possible or actual

1- patent ductus arteriosus
2- persistent left sided SVC in planned repair through the right atrium
3- aortic artery anomalies
4- poor LV function ≤ 35%
5- complex congenital heart disease, or
6- severe dilatation of the right sided structures
7- COPD with barrel shape chest

## CONCLUSION

The right anterolateral approach is suitable for many common open-heart surgeries. However, to ensure safe and expeditious performance of this technique, several key points must be emphasized. RALT was associated with minimal morbidity and an excellent cosmetic and functional outcome and a high level of satisfaction in our patient population

## REFERENCES

1. Ishtyak Ahmed Mir, A. G. Ahangar. Right thoracotomy approach for open heart surgery. International Journal of Research in Medical Sciences, 2015 Nov; 3(11): 3021-3026.
2. Vladimiro L. Vida, MD, PhD, Chiara Tessari, MD, Assunta Fabozzo, MD, Massimo A. Padalino, MD, PhD, Elisa Barzon, RN, Fabio Zucchetta, MD, Giovanna Boccuzzo, PhD and Giovanni Stellin, MD. The Evolution of the Right Anterolateral Thoracotomy Technique for Correction of Atrial Septal Defects: Cosmetic and Functional Results in Prepubescent Patients. (Ann Thorac Surg, 2013; 95: 242– 8).
3. Ying-long Liu, MD, Hong-jia Zhang, MD, Han-song Sun, MD, Shou-jun Li, MD, Jun Yan, MD, Jun-wu Su, MD and Cun-tao Yu, MD. Repair of Cardiac Defects through a Shorter Right Lateral Thoracotomy in Children. (Ann Thorac Surg, 2000; 70: 738–41).
4. Bleiziffer S, Schreiber C, Burgkart R, et al. The influence of right anterolateral thoracotomy in prepubescent female patients on late breast development and on the incidence of scoliosis. J Thorac Cardiovasc Surg, 2004; 127: 1474–80.
5. Yong-Qing Wang, Ru-Kun Chen, Wei-Wen Ye, Bing-Tang Zhong, Qi-Cai He, Zhi-Li Chen, Zhi-Jun Li. Open-Heart Surgery in 48 Patients via a Small Right anterolateral Thoracotomy. Tex Heart Inst J, 1999; 26: 124-8.