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Case Report

Lower mini-sternotomy for atrial septal defect repair in a young African woman

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Minimally invasive cardiac surgery (MICS) as an alternative to the traditional full sternotomy approach has gained major interest in recent decades. Compared to conventional techniques, MICS has been associated with a shorter hospital stay, reduced risk of infection, and better cosmetic results. We report the case of a 28-year-old female who underwent surgical repair of ostium secundum atrial septal defect (OSASD) via a lower mini-sternotomy (LMS).

Key words: Minimally access cardiac surgery, atrial defect, sub-Saharan Africa.

INTRODUCTION

Minimally invasive cardiac surgery (MICS), as compared to the traditional full sternotomy approach, is performed through several types of smaller chest incisions. Since reports by Cosgrove and Sabik (1996) three decades ago, who first described a 10-cm parasternal incision as an alternative to full sternotomy in patients undergoing aortic and mitral surgery (Cosgrove and Sabik, 1996; Navia and Cosgrove, 1996), MICS has increasingly gained interest in developing a wide range of small incisions that facilitate repair via direct vision or with endoscopic methods, including robotic assistance (Detter et al., 2004; Harky et al., 2020). Indeed, advances in biomedical technology with the development of specialized instrumentation, percutaneous devices, and videoscopic assistance have played a key role in the adoption of these techniques (Cocchieri et al., 2021). Common accesses in MICS include a variety of mini-thoracotomies (right or left) and limited sternal incisions, whose location depends on the planned procedure and the surgeon's preference. The effectiveness of MICS techniques has been demonstrated in both congenital and acquired heart diseases, reporting better cosmetic results, lower infection rates, fast functional recovery, and shorter hospital stays compared to standard sternotomy (Sà et al., 2020; Luo et al., 2001).

Although previous reports have demonstrated the cost-effectiveness of MICS in addition to the feasibility of selected MICS techniques, even in limited resource settings (Kandakure et al., 2020), few attempts have been made to develop less invasive accesses in

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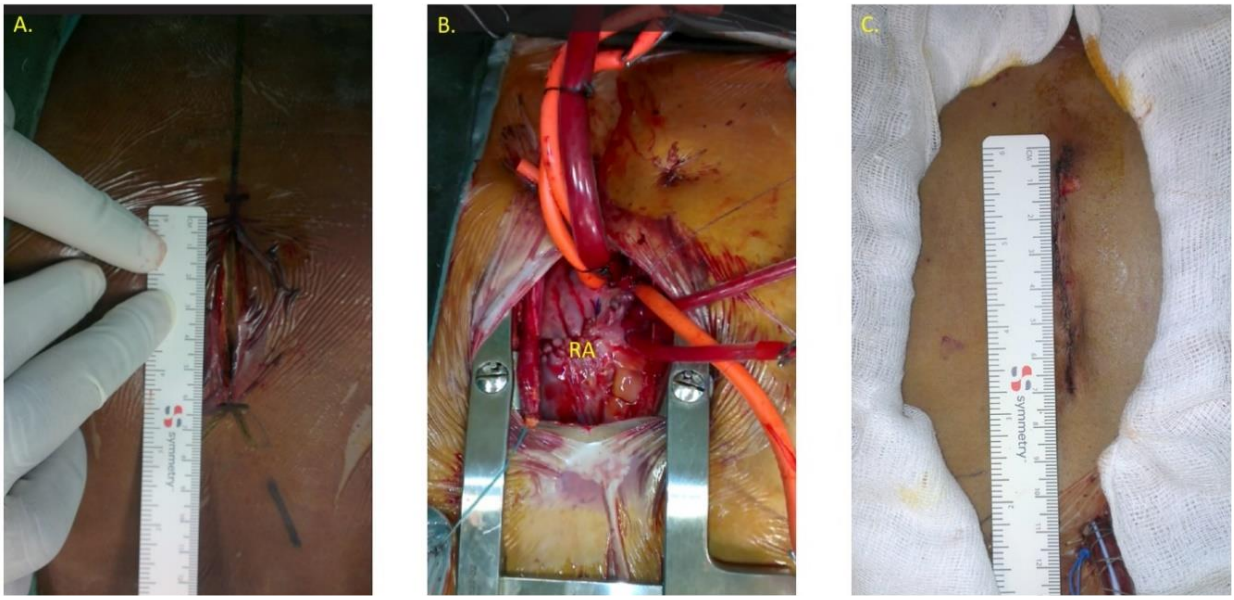

Figure 1. (A) Lower incision site; (B) exposure of the right atrium; (C) sternal suture line (6-7 cm).

developing nations.

Herein, we describe the case of a young black African female who underwent surgical repair of an atrial septal defect via a lower mini-sternotomy approach in our institution.

CASE PRESENTATION

A 28-year-old female with a long history of exertional dyspnea and palpitations was referred to our institution from an outside institute with a suspected diagnosis of atrial septal defect. The patient was asymptomatic at the time of admission, and the vital signs were normal (blood pressure: 124/85 mmHg; heart rate: 77 bpm; SO_2 98% in air; temperature: 36.8°C). The physical examination revealed a normal body characteristic (49 kg; 156 cm, body surface area: 1.45 m^2, Body Mass Index 20.13) and no signs of syndromic features. A 12-lead electrocardiogram showed normal sinus rhythm, whereas a transthoracic echocardiogram (TTE) revealed a large type II atrial septal defect (3.5 cm) associated with dilation of the right cavities and mild signs of right ventricular dysfunction (TAPSE 17 mm). In the absence of a superior rim of the defect that contraindicated percutaneous closure, the patient was referred to our unit for elective surgery. Following a discussion with the patient, who expressed a desire to avoid extensive scars from a full sternotomy, a consensual decision was made to consider a limited sternal approach through an inverted L lower mini-sternotomy (LMS). This was feasible, as it did not require additional instruments or consumables, as for our surgical routine. After a 7 cm skin incision (Figure 1), a muscular flap was mobilized to expose the sternum, including the intercostal spaces 2 to 3 cm from the right sternal margin. An inverted L LMS directed to the fourth right intercostal space was then performed using an oscillating saw. Pericardial stitches were placed in the usual fashion, with lower positions on the right side. Direct canulation of the ascending aorta and the two caval veins (Cannulas: aortic 18 Fr, superior vena cava 18 Fr, inferior vena cava 28 Fr) was performed through an LMS opening. Aortic cross clamping and cardioplegia delivery (antegrade cold blood cardioplegia in the aortic root) were then performed as per conventional sternotomy. The right atrium was easily entered, and the defect was exposed using suspension stiches. The closure of the defect was then done using a heterologous pericardial patch with a 5.0 monofilament running suture. Atrial closure and deairing maneuvers were performed in the usual fashion, and the patient was successfully weaned from the cardiopulmonary bypass. Sternal and skin closures were performed as for full sternotomy. The postoperative scar is as shown in Figure 2. The postoperative course was uneventful, and the patient was discharged on Day 4 postoperatively in good clinical condition.

DISCUSSION

Minimally invasive therapy, whether with catheter-based interventional procedures or minimal access surgical approaches, has gained growing interest in the treatment of cardiovascular diseases over the past few decades (Ramlawi, 2016; Reichenspurner, 2016; Easterwood et al., 2018). Beyond providing better cosmetic results, less invasive techniques have been associated, among other

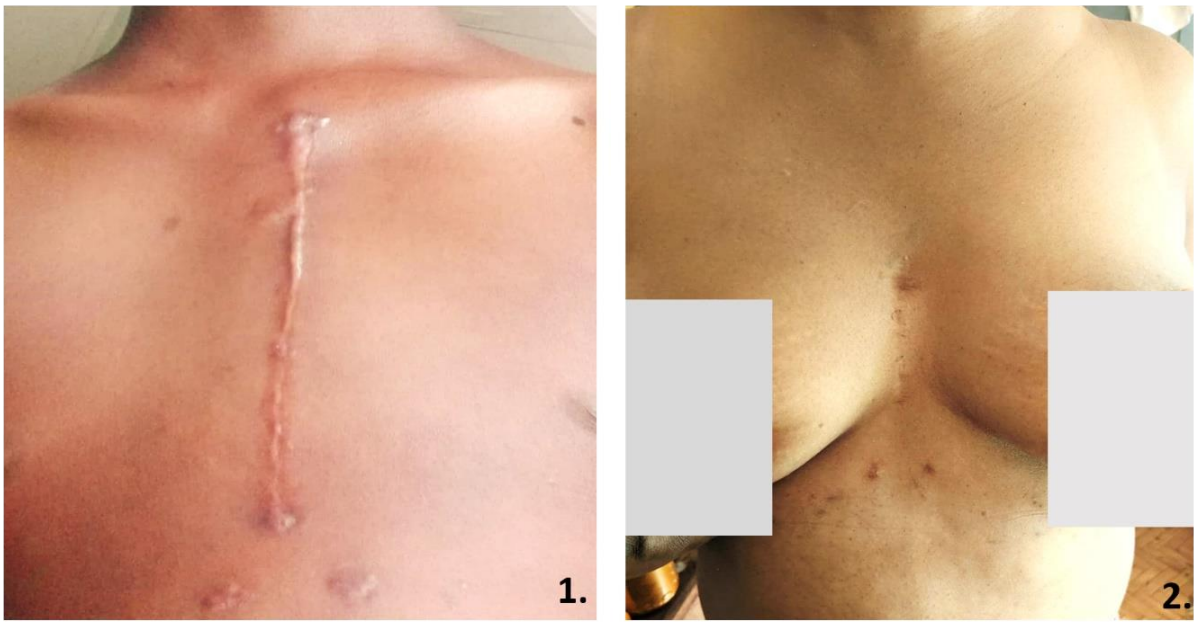

Figure 2. Postoperative comparison of surgical scars. Full sternotomy in a previously operated patient (1) and LMS in the current case (2).

things, with shorter hospitalization, reduced blood loss and transfusion, fast functional recovery, and in selected cases, similar clinical outcomes compared to conventional sternotomy (Doenst et al., 2017; Karangelis et al., 2021; Nakanishi et al., 2012; Almeida et al., 2022). Several minimally approaches have been described as alternative conventional sternotomy including various thoracotomies accesses and partial sternotomies (Faraz et al., 2022). Mini-thoracocomies have been the most commonly used covering a large spectrum of cardiac operations (mitral, aortic, multivalvular and coronary bypass), whereas mini-sternotomies (upper and lower) have been mainly reported in both aortic procedures and interventions requiring trans-atrial repair such as mitral surgery and some congenital defects repair. When compared with median sternotomy, mini-sternotomy approach has been associated with shorter hospitalisation, fast functional recovery, and better improvement of the quality of life. In a randomized study by Luo et al. (2001) LMS provided comparable results as compared to full sternotomy in the repair of congenital heart defects. Despite the operative times were longer in LMS patients, this technic was associated with reduced post operative drainage, shorter hospital stays and better cosmetic results (Luo et al., 2001). Similar outcomes were reported by Vieites et al. (2015) reporting less post operative complications in the LMS group as compared to full sternotomy suggesting LMS as a technic of choice in patients undergoing elective congenital heart defect repair. However, the setup of a successful MICS program remains a challenge and might require a longer learning curve with increased costs in terms of initial investment in devices and medical equipment (Vo et al., 2019). Indeed, the development of a MICS unit might seem unrealistic in a context with limited medical expertise, low surgical volume, and financial constraints, such as in developing countries.

However, as African cardiovascular surgeons, nowadays, we believe that the idea of a MICS program being an irrational objective in SSA centers must be revised. First, the earlier reports suggesting excessive costs from MICS compared to conventional sternotomy have been contradicted by several cost analysis studies. In papers comparing minimally invasive mitral surgery with traditional techniques, Atluri et al. (2016) and Downs et al. (2016) did not report evidence of increased costs in MICS groups. Perin et al. (2021) in the UK National Health Service described similar findings, and despite the operative costs (devices and equipment) being higher in the MICS groups, this was balanced by reduced hospital expenses related to low pharmacy requests and shorter ward and hospital stays. Other studies have even reported better savings with MICS through reduced in-patient and post-discharge services above 17.2 to 20% as compared to conventional sternotomy (Iribarne et al., 2012, 2011; Gersak et al., 2005; Grossi et al., 2014). This reduction in costs was indeed related to a short hospital stay in MICS patients, which translated into low costs in boarding and nursing, medications, laboratory tests, and cardiac imaging.

As the goal in cardiac surgery is to guarantee effective repair with the best technique to ensure good patient survival and quality of life (physically and mentally), this principle should not be revised downwards when it comes

to our patients. It might appear less ethical to exclude our patients a priori from a treatment from which they could reasonably benefit simply because “they do not deserve it.” Cardiovascular surgeons in SSA must rise to the challenge and become surgeons of their time by filling the gap with international standards. To some extent, embracing innovation by moving to a MICS program is more a change of surgical mindset than a matter of resource availability.

In the current case, no additional costs for medical equipment or consumables were required. The surgical instruments, including needle holders, forceps, vascular clamps, and ECC consumables (cannulas, circuits, vents) were the same as for our routine sternotomy. Other authors have supported the feasibility of MICS via LMS using familiar instruments in selected cases (Hesham and Ahmed, 2016; Luo, 2001). Indeed, in our context, an LMS was preferred over a right mini-thoracotomy or a mid-axillary incision (Konstantinov and Buratto, 2021; Konstantinov et al., 2022). An attempt to repair the defect through a right mini-thoracotomy could have been arduous in the absence of specialized devices for peripheral canulation, transthoracic clamping, and longer surgical instruments that were not available in our institution. However, the LMS opening was adequate and provided sufficient space for direct central cannulation while maintaining good exposure of the atrial cavities. Other lesions requiring trans-atrial exposure, including congenital (partial atrioventricular defects, ventricular defects) and acquired valvular lesions (mitral and tricuspid), have been repaired through this approach with good results (Ling et al., 2018; Greelish et al., 2003; Kobayashi et al., 1998). Of note, we found a longer time for the ECC setup (including the sternal opening) but a similar cross-clamping duration compared to our conventional full sternotomy procedure. Moreover, the deairing maneuvers were prolonged due to persistent intracavitary bubbles in the absence of adequate carbon dioxide insufflation. In some cases, a more cranial location of ascending aorta could compromise a central cannulation through the LMS opening. In these cases, peripheral arterial cannulation and transthoracic cross clamping should be considered. We believe these were minor events that had little impact on the clinical outcome and will be addressed through an increase in surgical volume.

In selected patients with isolated congenital or acquired valvular lesions, surgical repair via an LMS can be safely performed with traditional instruments, with no increase in hospital costs. This approach provides various clinical and cosmetic benefits compared to conventional sternotomy and should be promoted in low-middle-income regions.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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