



Establishing a Sustainable Cardiac Surgical Programme at NICVD, Sukkur: Experience of 1100 Open Heart Surgical Cases.

Vikram Kumar ^{*1}, Kashif Zia, Ali Raza Mangi, Hafeezullah, Kamal kumar

***Correspondence to:** Vikram Kumar.

Copyright

© 2023 **Vikram Kumar**. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Received: 08 August 2023

Published: 01 September 2023

Abstract

Objective: *This study aims to assess the short term outcomes and in hospital and short-term outcomes of the first eleven hundred adult cardiac surgical operations carried out in a recently established satellite facility in Sukkur, Pakistan.*

Methods: *NICVD Sukkur, a new satellite of the National Institute of Cardiovascular Diseases (NICVD) in Pakistan, conducted 1100 adult heart operations between March 2018 and December 2020 and follow up of one year. Patients received on-pump coronary artery bypass (ONCAB), off-pump coronary artery bypass (OPCAB), aortic valve replacement (AVR), congenital adult congenital heart disease (ACHD), mitral valve replacement (MVR), and minimally invasive cardiac surgery (MICS) from NICVD expert faculty with a minimum of five years' experience post-fellowship.*

Results: *Patients undergoing cardiovascular procedures at this satellite facility had a mean age of 47.58 ± 14.6 years, with men making up 77.5% of the total. The highest prevalence of risk factors was found in those with hypertension (34%), followed by smoking (32.5%), diabetes (20%), and dyslipidemia (13.5%) in that order. Patients in this study had a mean Euro SCORE II of 1.23 ± 0.50 , with a maximum score of 2.3 seen in 3 individuals. Out of 1100 procedures, 50% were ONCAB, 20% were OPCAB, 15% were MVR, 4% were AVR, 9% were ACHD, and 2% were MICS. Survival status post-operative as well as after one year was 98.3% with a cumulative mortality rate of 1.7% (19). The average time spent on mechanical ventilation after surgery was 2.13 2.73 hours, and the frequency of post-operative hemorrhage was 3%, leading to re-explorartion. The average length of stay in the hospital was 5.41 0.165 days. At one year, 4% of cases were lost to follow-up. 39.5% of the patients had reported mild-to-moderate retrosternal pain during the follow-up evaluation, and 4.2% had a superficial surgical site infection of the sternal wound. 38.5% of patients experienced a significant improvement in functional class, whereas 4.2% (four) experienced a significant decline in functional class after surgery*

Conclusion: *Sukkur residents now have access to tertiary care and early cardiac surgery facilities without having to travel far from their homes, thanks to a newly established satellite centre.*

Keywords: *cardiovascular diseases, cardiac surgery, Pakistan, satellite center.*

Introduction

Recent years have shown a dramatic rise in cardiovascular disease cases in Pakistan, and this just reflects the tip of the proverbial iceberg (1). In Pakistan, even the most recent data on the prevalence of heart conditions including coronary artery disease and rheumatic heart disease that need treatment by surgery goes back at least a decade [1-4]. Due to the preponderance of metropolitan area medical facilities in the practice of cardiac surgery, a disproportionate share of the field's patients lives there. Therefore, strategies should be formulated to improve healthcare quality and geographic accessibility for patients dwelling in far-flung areas. More than 400 patients were on the waiting list for cardiac surgery at the National Institute of Cardiovascular Diseases (NICVD) in Karachi before the opening of surgical centers in Sukkur, Larkana, and Tando Mohammad Khan (TMK) in Sindh province of Pakistan. This prompted the introduction of such facilities in other parts of the Sindh province. This number, along with early admissions, decreased travel time, routine follow-up visits, and patient financial burden, has been drastically reduced recently. There have been reports that South Korea is considering building regional heart surgery facilities to better serve its patients' needs [5-6]. Since the United States anticipates a deficiency of cardiothoracic surgeons by 2020s [7-8], there will be enough opportunity to successfully complete the training requirements of an increasing number of young cardiac surgeons. This cutting-edge satellite facility in Sukkur with 300 beds opened on February 24 back in 2017. In addition to an on-call cardiac emergency room, a catheterization lab, a coronary care unit, consulting clinics, advanced diagnosis, adult and paediatric cardiology, echocardiography, coronary artery angioplasty, angiographies, and a cardiac surgical suite, this facility offers a full range of cardiology care. Getting timely cardiac treatment has been much simpler because of NICVD's recent opening of satellite facilities in Sukkur, Larkana, and TMK that are able to perform heart surgery. In March of 2018, NICVD Sukkur performed 1st ever heart surgery in interior region of Sindh province

of Pakistan. Sukkur city and the neighbouring regions, including Punjab specially southern region and most of the Balochistan Province have benefited from this facility's comprehensive cardiac surgery care. More than 1600 patients have been undergone open heart surgery at Sukkur's newly established centre. The major goal of this research was to assess the results of the first 1100 adult and congenital cardiac operations performed at the newly created cardiac surgery programme at Sukkur, NICVD, Pakistan.

Methods

This research is a 12-month follow-up of the first eleven hundred cardiac surgery patients treated at the NICVD's new satellite facility in Sukkur from March 2018 till December 2020. Before having cardiac surgery, patients were vetted by the heart team and determined to meet the standards set out by the American Heart Association recommendations. Patients and their loved ones gave their permission to surgery before it was performed. Patients' risk levels were assessed using an online version of the European System for Cardiac Operative Risk Evaluation (EuroSCORE) II calculator [9]. To reduce the risk of problems after surgery, standard preoperative care was supplied to all of the patients who had voluntarily chosen to have the procedure [8]. Patients could have chosen between a variety of procedures performed by NICVD faculty with a minimum of five years experience post-fellowship, including on-pump coronary artery bypass (ONCAB), off-pump coronary artery bypass (OPCAB), aortic valve replacement (AVR), mitral valve replacement (MVR), minimally invasive cardiac surgery (MICS), and congenital procedures.

Standard median sternotomy was done and routine heart lung machine used for bypass. St Thomas cardioplegia administered antegrade or retrograde with topical cooling for ONCAB and valvular surgeries with a goal activated clotting time exceeding 480 seconds. The OctoBase sternal retractor, the Octopus stabilizer, the Urchin positioner, and the AccuMist Blower were used during the OPCAB procedure. The original method of OPCAB myocardial protection was shunting blood from the left internal mammary artery (LIMA) to the left anterior descending artery (LAD), with diverting shunts sizes ranging from 1.0 to 2.0 used. Atrial septal defects (ASDs) were closed in similar fashion as well as Minimally invasive approach. Each patient was expected to return to the cardiac surgery out patient clinic at NICVD Sukkur for standard follow-up visits at least four times following discharge: one week,

one month, six months, and one year after the operation, while valvular patients were registered with INR clinic before discharge. They were also reminded to return for a second appointment by mobile phone. Early postoperative echocardiography was done, and all patients had a follow-up echocardiogram at six months post-procedure. The international normalized ratio (INR) clinic was in charge of patients who needed vitamin K antagonists (VKA). For speedy recuperation, all patients were sent to the rehab facility. Patients in urgent need of medical care were encouraged to visit the NICVD clinic or emergency department at any time. The patients were monitored throughout their hospital stays, and their mortality, morbidity, length of stay, ventilation time, post-operative hemorrhage, re-operation, and re-intubation rates were all calculated in the first 30 days after surgery. After a year had passed, the patients were checked on for things like recurrence of illness, survival rate, echocardiographic findings, and complaints. For the statistical analysis, we used SPSS version 26.

Results

Patients undergoing cardiovascular procedures at this satellite facility had a mean age of 47.58 ± 14.6 years, with men making up 77.5% of the total. The highest prevalence of risk factors was found in those with hypertension (34%), followed by smoking (32.5%), diabetes (20%), and dyslipidemia (13.5%) in that order. Patients in this study had a mean Euro SCORE II of 1.23 ± 0.50 , with a maximum score of 2.3 seen in 3 individuals. The average ejection fraction (EF) was 55.34 ± 2.2 . Table 1 shows the gender breakdown of patients' baseline sociodemographic and clinical data.

Parameters	Male	Female
N	852 (77.5%)	248 (22.5%)
Age	51.24 ± 12.5	37 ± 13.4
Weight	74 ± 14.4	61 ± 16.3
NYHA Classification		
I	17(2%)	23 (10%)
II	304 (35%)	25 (11%)
III	347 (40%)	176 (76%)
IV	201 (23%)	7 (3%)
Co-morbidities		
Diabetes	173 (20%)	23 (10%)
dyslipidemia	52 (6%)	27 (12%)

Hypertension	325 (38%)	162 (30%)
smoking	312 (36%)	18 (8%)
Prior stroke	4 (0.6%)	1 (0.3%)
Ejection fraction	55.43±7.23	56.75±7.5
EURO score II	1.25±0.32	0.89±0.54

Table 1: Patient characteristics by gender at baseline, including demographics and health status

Almost 40% of the smokers had smoked more than a pack a year in the past. Before surgery, these patients were evaluated for pulmonary function using a spirometry test and physiotherapy for the chest. 67 percent of the diabetic patients had uncontrolled insulin-dependent diabetes mellitus, whereas 25 percent were diagnosed with diabetes by chance during regular preoperative laboratory tests. Patients with diabetes had a HbA1c mean of 10.2±2.0, indicating that they would only be surgical candidates after their HbA1c levels dropped to 7.5. These patients had surgery with a target blood sugar determined by guidelines and an insulin infusion calculated for the perioperative period. Figure presents the frequency distribution of the various sorts of processes.

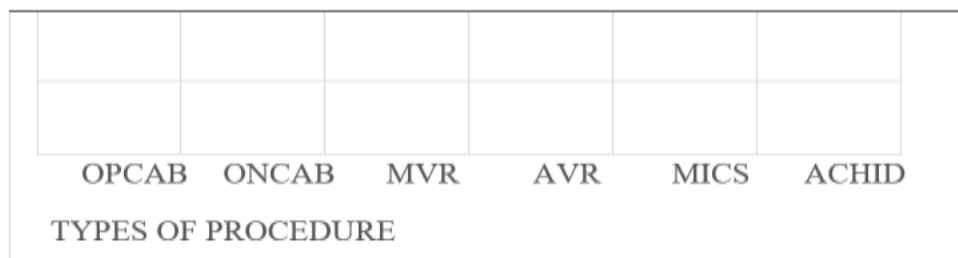


Figure 1: Frequency distribution of types of first 1100 procedures performed at Sukkur satellite center

706 patients were admitted for elective CABG procedures via the outpatient clinic, 1 patient presenting with symptoms of cardiogenic shock required immediate surgery. Only one-seventeenth (38%) of CABG operations were OPCAB, whereas the remaining 62 percent have ONCAB procedures. Complete revascularization was still our top priority; the LIMA was selected as the optimal conduit for the LAD to maximize the patient's survival benefit. We were able to successfully anastomose a mean of 3.1±1.6 distal grafts, with 145 patients in the CABG group requiring two distal targets.

Table 2 shows the breakdown of how often certain operations are performed with their associated diagnoses and their subsequent results. In 657 (93%) of 707 patients, the LIMA was anastomosed to the LAD; in 40 patients, the LIMA was not utilized due to concomitant conditions and expected survival; and in 10 patients, the LIMA was injured during surgery. Among patients who had adult congenital heart surgery, two were candidates for minimally invasive right anterior mini-thoracotomy ASD closure. Total 22 patients underwent for MICS.Re-exploration was performed on 33 patients. 5 was found to have cardiac tamponade after surgery, necessitating immediate surgery to release the tamponade in the intensive care unit (ICU) before the patient could be sent to the operating room. 5 patients had significant bleeding during surgery, both of which were successfully treated there. 21 patients who had CABG had an intra-aortic balloon pump (IABP) implanted for elective reasons, whereas one patient had an IABP installed for emergency reasons due to post-operative poor cardiac output (LCOS). Re-intubation was necessary for the LCOS patient because of subsequent respiratory failure. And another patient who needed dialysis due to post-operative renal failure was re-intubated at the same time. After surgery, six patients had an ischemic stroke, of which two couldnt survive and 4 were referred to dedicated stroke units and recovered.

Diagnosis and Procedure	Frequency
CABG	
Triple-vessel coronary artery disease	302
Two-vessel coronary artery disease	149
Left main with triple-vessel coronary artery disease	180
Left main with two-vessel coronary artery disease	76
Aortic valve replacement (mechanical valves)	
Severe symptomatic aortic regurgitation	13
Severe symptomatic aortic stenosis	20
Mitral valve replacement (mechanical valves)	
Severe symptomatic mitral stenosis	93
Severe symptomatic mitral regurgitation disease	43
Severe symptomatic mixed mitral disease	33
Secundum atrial septal defect	89
Conventional ventricular septal defect closure	
Ventricular septal defect	10

Post-operative outcomes	
Mortality	19
CVA	06
Low cardiac output state	29
Renal dysfunction leading to dialysis	08
Post-operative bleeding leading to re-exploration	33
Re-intubation	27
Ventilation time (hours)	2.13±1.67
Length of stay (days)	6.12±3.2

Table 2: Diagnosis, operations, and post-operative results of the first eleven hundred surgeries conducted at Sukkur satellite centre.

4% patients were lost to follow-up after one year, while the remaining 1050 patients, were tracked down effectively. At the time of the follow-up evaluation, 40% of patients reported mild to moderate retrosternal pain with numbness over the left parasternal area, 7% reported a superficial surgical site infection of the sternal wound, and one patient had a sternal dehiscence and required rewiring for sternal closure due to the condition. 45 percent of the patients showed statistically significant improvement in functional class, whereas 7% showed statistically significant decline; all four of these patients had problems during the postoperative period. Table 3 displays the patients' follow-up status one year later. Patients with complex surgery required re-intubation accounted for a significant portion of the mean 4.13±6.67 hours of post-operative mechanical ventilation. The mean number of days a patient spent in the hospital did not change from 4.12±3.2, and the rate of in-hospital death did not change from 1.7% cumulative mortality. Lost to follow-up at one year was 4%.

During the follow-up assessment, 39.5% of the patients had complained of mild-to-moderate intensity retrosternal pain and 4.2% had superficial surgical site infection of the sternal wound. A significant improvement in functional class was observed in 38.5% of patients, whereas 4.2% (four) had a significant drop-in functional class post-operatively.

Complaints	% (N)
Pain	40% (324)
Cough	37% (300)
Serous discharge	24% (194)
Muscle cramps	19% (154)
Sleeplessness	17% (138)
Anxiety	15% (121)
Immobility	5% (40)
Infection	
Superficial (SSI) sternal	7% (56)
Superficial (SSI) leg	5% (40)
Deep sternal wound infection	1.3% (14)
Sternal dehiscence	10% (81)
Function class	
Deterioration	7% (56)
Improvement	45% (365)
Echocardiographic assessment	
Deterioration ejection fraction	35% (284)
Severe pericardial effusion	1% (12)
Structural valvular deterioration	4% (32)
Paravalvular leak	1% (8)
Recurrence of disease	1% (11)

Table 3: The one-year results of monitoring the first eleven hundred surgical operations at the Sukkur satellite facility

Discussion

Local surgeons in Karachi, Lahore, and Rawalpindi were the first to do closed heart surgeries in Pakistan in the late '50s. However, in 1967 and 1968, a Canadian born missionary surgeon named Dr. Donald Edward Bowes started performing open-heart surgeries at United Christian Hospital Lahore [10]. Since the NICVD in Karachi was founded in the early 1970s [11-13], Pakistan has had a regular civilian cardiac surgery programme. Since then, NICVD has maintained its status as a national leader in cardiovascular care.

Heart patients in the developing world face additional challenges due to the inadequate healthcare infrastructure and the severity of their conditions [14]. There has been a dramatic increase in the number of patients needing heart surgery, yet there are only a small handful of publicly financed hospitals in Pakistan able to perform these procedures quickly. That left recruiting these patients and making them wait for their operation as the only option. Due to a shortage of rural cardiac facilities, many patients waiting for coronary bypass or valve-related operations suffered from unnecessary complications and even died while waiting for treatment. Consequently, increasing access to cardiac surgery coverage has persisted as a top priority for the medical community. There have been over 1600 successful heart procedures conducted at NICVD Sukkur. The NICVD team is working to make sure that people in Pakistan have access to high-quality cardiac care without having to go far for it.

The prevalence of diabetes, hypertension, paan/Gutka and tobacco use among the Sukkur population is quite high, which increases the likelihood of unfavorable consequences. However, we have maintained our success in demonstrating that the keys to positive outcomes at a recently established cardiac surgery institution are prompt surgical intervention, sufficient pre-operative treatment, and consistent follow-up. For surgeons to know whether global statistics are consistent with local findings, institutional outcomes are crucial. The NICVD Sukkur is the world's first publicly financed, state-of-the-art cardiac surgery centre, and it has produced remarkable surgical outcomes when compared to reputable Western standards.

The National Institute of Cardiovascular Diseases (NICVD) is an independent institute mainly financed and supported by Govt of Sindh, places a premium on postoperative care that does not cost patients or their families anything.

Standardized medicines, IABP, a continuous renal replacement treatment machine, an automated implanted cardiac defibrillator, a ventricular assist device, and extracorporeal membrane oxygenation are all available at this hospital. In other words, the best care was given to patients with a poor prognosis for recovery after surgery. This is a good example to set for other hospitals in the underdeveloped countries.

Conclusion

New cardiac surgery facilities are needed in Pakistan as the number of patients seeking these procedures rises. The availability of high-caliber cardiac surgical treatment has been facilitated by the opening of a satellite facility in Sukkur. Despite being a relatively new facility, the unit's veteran faculty support has led to exceptional pre- and post-operative care, with few problems recorded and international accepted mortality occurring in the first eleven-hundred patients treated.

References

1. Khan MS, Jafary FH, Faruqui AM, et al. High prevalence of lack of knowledge of symptoms of acute myocardial infarction in Pakistan and its contribution to delayed presentation to the hospital. *BMC Public Health*. 2007;7:284. DOI: 10.1186/1471-2458-7-284.
2. Jafary FH, Aslam F, Mahmud H, et al. Cardiovascular health knowledge and behavior in patient attendants at four tertiary care hospitals in Pakistan – a cause for concern. *BMC Public Health*. 2005;5:124. DOI: 10.1186/1471-2458-5-124
3. Iqbal R, Anand S, Ounpuu S, et al. Dietary patterns and the risk of acute myocardial infarction in 52 countries: results of the INTERHEART study. *Circulation*. 2008;118(19):1929-1937. DOI: 10.1161/CIRCULATIONAHA.107.738716
4. Nishtar S. Prevention of non-communicable diseases in Pakistan: a systemic approach. *J Pak Med Assoc*. 2004;54(10):529-535. PMID: 15521336

5. Bajwa MA, Zahid N, Sohail S, et al. Burden of cardiovascular diseases in Pakistan: a systematic review and meta-analysis of data from 1990 to 2018. *BMC Public Health*. 2019;19(1):1608. DOI: 10.1186/s12889-019-7892-2.
6. Park JB, Kwon TG, Kim HJ, et al. Trends in the incidence and management of acute myocardial infarction from 2011 to 2014: A nationwide observational study in South Korea. *Medicine (Baltimore)*. 2016;95(33):e4498. DOI: 10.1097/MD.0000000000004498
7. Kim H, Kim H, Nam C, et al. Construction of regional cardiovascular centers in Korea: Trends in the regionalization of cardiovascular health care in Korea from 2004 to 2014. *J Korean Med Sci*. 2016;31(Suppl 1): S20-S26. DOI: 10.3346/jkms.2016.31. S1.S20
8. Mery CM, Shayan SJ, Spector M, et al. Characterizing the decline in the cardiothoracic surgical workforce: Results from the Society of Thoracic Surgeons 2013 workforce survey. *Ann Thorac Surg*. 2014;98(2):487-495. DOI: 10.1016/j.athoracsur.2014.03.060
9. Seder CW, Pugliese SC, Singh AK, et al. The impending cardiothoracic surgeon shortage: Impact and potential solutions. *J Thorac Cardiovasc Surg*. 2010;139(4):863-871. DOI: 10.1016/j.jtcvs.2010.01.011
10. <https://euroscore.org/index.php?id=17&lang=en>
11. Kertai MD, Boersma E, Bax JJ, et al. A meta-analysis comparing the prognostic accuracy of six diagnostic tests for predicting perioperative cardiac risk in patients undergoing major vascular surgery. *Heart*. 2003;89(11):1327-1334. DOI: 10.1136/heart.89.11.1327
12. Roques F, Nashef SA, Michel P, et al. Risk factors and outcome in European cardiac surgery: analysis of the EuroSCORE multinational database of 19030 patients. *Eur J Cardiothorac Surg*. 1999;15(6):816-823. DOI: 10.1016/s1010-7940(99)00106-2
13. afary FH. Profile of National Institute of Cardiovascular Diseases (NICVD), Karachi. *J Pak Med Assoc*. 2005;55(8):345-347. PMID: 16119613

-
14. Baig-Ansari N, Pasha O, Shah N, et al. Heart diseases in Pakistan: A review of published studies. *J Pak Med Assoc.* 2004;54(10):534-540. PMID: 15521337.

 15. Gaziano TA, Bitton A, Anand S, Abrahams-Gessel S, Murphy A. Growing epidemic of coronary heart disease in low- and middle-income countries. *Curr Probl Cardiol.* 2010;35(2):72-115. DOI: 10.1016/j.cpcardiol.2009.10.002

