

RESEARCH ARTICLE

Outcome of Cardiac Surgery in Kafrelsheikh University Hospital: Early Experience

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Abstract

Introduction: The development of modern cardiac surgery after invention of cardiopulmonary bypass, new surgical techniques and advanced equipment has reduced the mortality rates and improved the outcome. There are more than 4000 cardiac surgery centers worldwide, but with unfair distribution: North America has one center per 120,000 population, while sub-Saharan Africa and Southeast Asia have just one center per 33 million and 16 million population, respectively. Thus, there is a real need to establish cardiac surgery centers in regions of need, especially in low- and middle-income countries. Starting cardiac surgery in a new university hospital with professional surgeons, well equipped operating rooms and unexperienced paramedical team is a true challenge..

Objectives: The objective is to evaluate the outcome of cardiac surgery in Kafrelsheikh university hospital from the beginning in 2018 till the end of the study.

Materials and methods: A total of 428 consecutive patients underwent heart surgery at Kafrelsheikh University Hospital from 2018 through October 2023, were included in this retrospective and prospective data analysis. An overarching trend in cardiac surgery throughout time was more important than providing particular insights into groupings of procedures.

Results: Between 2018 until its conclusion, this prospective and retrospective research tracked patients who had heart surgery at Kafrelsheikh University Hospital.

In all, 428 operations were carried out during the research period, with 2023 seeing the highest annual case count of 103. From 2018 (n=41) to 2023 (n=103), the percentage of elective heart surgery operations has been continually rising.

There was no notable disparity in age across the categories, with the exception of 2018 (P value<0.001). Among all six groups, there was no statistically significant difference in sex or BSA. The numbers of people who had heart procedures in the past were much greater in the 2023 and 2022 groups compared to the 2020, 2019, and 2018 groups (P = 0.025).

Aortic cross-clamp time and cardiopulmonary bypass time were significantly lower in (group 2023, 2022 and 2021) than (group 2020, 2019 and 2018) (P value<0.05).

In comparison to groups 2020, 2019, and 2018, the durations of mechanical ventilation, intensive care unit stays, and hospital stays in groups 2023, 2022, and 2021 were considerably shorter (P value<0.001).

Our study reveals that mortality and morbidity are the same without significant difference (p value : 0.987).

Conclusion:

Considering our center's relative youth and the high prevalence of comorbidities among our patients, we maintain that our death and morbidity rates are within acceptable ranges. We have also seen improvements in a number of other quality indicators.

Such results in our early experienced center reflects the marvelous progress of our surgeons and that led to doing complicated surgical procedures as bentall, off pump surgery, valve repair and other difficult cases with comorbidities. It also shows how the surgical intensive care unit and paramedical team have improved their abilities, which has led to better infection control and healthier patients. Our facility may be brand new, but the high-quality tools we use allow our surgical teams to greatly enhance their patients' well-being and the success of their procedures. Important to the result was the collaboration between different sections of our facility.

INTRODUCTION

An authorized heart surgery program in a regional area would mirror the goals of the National Strategic Framework for Rural and Remote Health which aim to enhance equality in health care access.(1)

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If a patient has complicated cardiovascular disease, the best course of therapy is still cardiac surgery. Launching a heart surgical program in a big regional population is no easy feat; it calls for meticulous preparation and management. Affordable, safe, and efficient cardiac surgery based on the best available data is the ultimate goal.(2). Gold Coast University Hospital's (GCUH) new adult cardiac surgery program now offers an operating room (OR) dedicated to heart procedures. Moreover, the difficulties encountered and wisdom gained from these experiences are detailed as well. A wide variety of heart disorders, including severe coronary artery disease, may be diagnosed and treated by the highly trained professionals who work in the field of cardiac surgery.(2)

A variety of highly skilled procedures, including valve surgery and coronary bypass grafts, are available to patients when they are referred to these services. Providing comprehensive care to patients before, during, and after cardiac surgery, a multidisciplinary team of experts works together in the operating room to ensure a smooth process for the patient. On a high level, cardiac surgery services include a cardiac operating room (OR), a coronary care unit (CCU), an intensive care unit (ICU), and a cardiac surgical ward.(3)

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Heart surgery requires skilled personnel and expensive equipment, which may put a strain on a hospital's budget. To ensure the unit's long-term viability and to stay under budget, there must be a well-defined plan and consistent funding, supported by sensible decision-making (48).

New cardiac services are required by ANZSCTS standards to be located at tertiary hospitals that have the resources to ensure patients are well-cared for before to and after heart surgeries. An established referral connection with a respected, recognized cardiac surgery facility for at least three years is also crucial for this new service.(3)

Establishing a culture of quality development by monitoring and matching the standards of care supplied requires a substantial ongoing investment of time and resolve from the whole team in order to successfully implement the new cardiac operating room. The capacity to handle change, work arrangement, and perioperative abilities will all see improvements simultaneously. Inevitably, several obstacles will stand in the way of achieving the stated goals of launching a new healthcare service.(4)

As part of change management, continuous assessment is essential. This last phase is often overlooked, but it is crucial to inquire about the results and longevity of the modification, as well as whether or not any more steps are necessary. Quality reflection, which verifies the project's results, should follow. After conducting an evaluation, it may be necessary to go back to the beginning of the change management process and make some adjustments. You shouldn't take these steps personally; they're just part of the transformation process.(5)

Estimating the incidence of postoperative complications and postoperative mortality has been approached using several evaluation methodologies. Several of these instruments have been reported to be extremely helpful, with numerous updated versions boasting greater accuracy; these include the APACHE, the physiological and POSSUM, and many more.(6)

Nevertheless, the extensive list of necessary test items and intricate mathematical techniques have proven to be challenges, despite the methods' intended usage in the area of acute care. As a result, these techniques aren't good for quick score calculations after surgery, identifying high-risk patients, or determining admissions to the intensive care unit.(7).Serum lactate, the risk adjustment for congenital heart surgery (RACHS)-1, the Society of Thoracic Surgeons–European Association for Cardio-thoracic Surgery (STAT) score, the required time for cross-clamp and bypass, and high PIP and PEEP are some other simpler postoperative monitoring parameters that may reveal postoperative outcomes.

While several studies have shown that elevated lactate levels are predictive of successful postcardiac surgery, the specific procedures and levels of lactate that were considered in this research varied widely. To fully understand the relationship between lactate levels and their effects, further research is needed.(8)

Even though RACHS is a widely used grading system, it doesn't include specifics about the patient's critical care environment. In a similar vein, STAT emphasizes mortality risk above end-organ failure and disregards the clinical condition. Despite considering the patient's condition, VIS only makes a moderate forecast, according to research.(9)

Mehmood et al. found no correlation between the amount of time spent under cross-

clamp and bypass and the duration of mechanical ventilation or the length of time a patient spent in the hospital. They proved that several confounding variables affect results more significantly. There needs to be further research on the reliability of cross-clamp and bypass time as predictors of outcomes in juvenile cardiac surgery. These indices do a good job, but the VVR score really nails it when it comes to measuring the success of postcardiac surgery.(10)

PATIENTS AND METHODS

Patients

From 2018 through October 2023, a total of 428 consecutive patients underwent heart surgery at Kafrelsheikh University Hospital were included in this retrospective and prospective data analysis. An overarching trend in cardiac surgery throughout time was more important than providing particular insights into groupings of procedures.

Inclusion criteria:

- Everyone who has heart surgery.
- Both sexes.
- Surgery type: valvular, on-pump or off-pump CABG, congenital cardiac, cardiac mass, or pericardial; operation classification: elective or urgent; LV function: excellent to bad; as well as comorbidities.

Methods:

Preoperatively

All patients were subjected to the followings:

- Demographic data, Complete history and any previous examination
- M-mode echocardiography to quantify EF, and continuous wave doppler of the tricuspid flow to determine the estimated systolic pulmonary artery pressure. Before surgery, patients with high pulmonary artery pressure were given sildenafil, and during the procedure, milrinone was administered.
- Routine laboratory investigations
- APACHE II and SOFA score were evaluated

Intraoperative data were documented including type of surgery , type of cannulation , type of cardioplegia , bypass time and aortic cross clamp time

Postoperative data and outcome

Close monitoring of the patients was maintained throughout their hospital stay. The primary metric for success was the rate of illness and death within 30 days. Complications, length of stay in ICU and the ward, duration of ventilation, and the requirement for inotropes were all presented as measures of outcome. Cardiovascular, respiratory, neurological, renal data and wound infection were analysed.

Statistical analysis:

The statistical study was conducted using SPSS v26, which was developed by IBM Inc. and is based in Chicago, Iowa, USA. To determine whether the data was normally distributed, the Shapiro-Wilks test and

histograms were used. SD and mean (Q) were used to display quantitative parametric data. The median and IQR were used to display quantitative non-parametric data. The frequency and percentage (%) of qualitative characteristics were shown.

RESULTS (data are presented as mean \pm SD)

results

There was no statistically significant difference in age, sex and BSA among the six groups categories, with the exception of 2018 ($p < .001$). There was statistically significant difference in atrial fibrillation, diabetes mellitus, hypertension, or pulmonary hypertension.

Clinical results

The numbers of people who had heart procedures in the past were greater in the 2023 and 2022 groups compared to the 2020, 2019, and 2018 groups ($p = .025$). In comparison to groups 2021, 2020, 2019, and 2018, the ejection fraction in 2023 and 2022 was much lower ($p < .05$).

Compared to the other groups, group 2020 has statistically significantly greater rate of CABG ($p = .003$). Group 2023 has statistically significantly greater MVR, AVR, and TVR compared to the other groups ($p < .001$). Group of 2019 had the highest AVR ($p = .015$). The 2018 group had considerably greater rates of VSD and common AV canal compared to the other groups ($p < .05$). Aortic coarctation, pericardial window and emergency stab heart, occurred in group 2023 and didn't occur in other groups. TOF occurred in group 2018 and didn't occur in other groups. Combined CABG and AVR, tricuspid valve replacement and pericardial cyst occurred in group 2022 and didn't occur in other groups. Groups of 2023, 2022, and 2021 had a much shorter surgical duration compared to groups 2020, 2019 and 2018 ($p = .001$).

Type of cannulation has no statistically significantly different among the six groups. Custodial (Bretschneider) cardioplegia was significantly higher in all groups than group 2023 ($p < .001$). Aortic cross-clamp time and cardiopulmonary bypass time were significantly lower in (group 2023, 2022 and 2021) than (group 2020, 2019 and 2018) ($p < .05$).

The study revealed no statistically significant difference among the six groups, concerning the need for inotropes, bleeding, need for reopening, superficial wound infection, deep wound infection, incidence of sternal dehiscence, mortality, hemorrhagic effusion, renal impairment, neurological impairment, chest infection, ARDS and transient ischemic attack were insignificantly different among the six groups.

In comparison to groups 2020, 2019, and 2018, the durations of mechanical ventilation, intensive care unit stays, and hospital stays in groups 2023, 2022, and 2021 were considerably shorter ($p < .001$). The study revealed that mortality and morbidity are the same without significant difference ($p = .987$).

DISCUSSION

Medical care and perioperative cardiac surgical critical care have advanced to the point where cardiac surgery has shown significant improvement. Contrarily, there has been an increase in the percentage of high-risk patients undergoing cardiac surgery, and this is mostly attributable to the growing number of older patients who come with many medical conditions.(11)

By assisting with the maintenance of systemic perfusion and oxygenation, CPB is a commonly used procedure in open-heart surgery. Since the cost and quality of life of patients are key considerations after cardiac surgeries, it is necessary to examine outcomes such as postoperative morbidity and mortality. The lack of a correlation between mortality and other measures of healthcare quality and cost-effectiveness, such as complication rates and length of stay, makes mortality an inadequate metric by itself.(12).

The length of time a patient spends in the hospital and ICU, as well as the prevalence of complications including heart, lung, renal, and neurological diseases, infections like pneumonia and sepsis, and other infections are measures of both the quality of treatment and the quality of life after cardiac surgery. Consequently, it is critical to determine what variables put patients at increased risk for significant postoperative morbidity and extended durations of hospital stays after surgery.(13) Anesthesia risk evaluation scores, Tuman scores, Tu scores, and the European System for Cardiac Operative Risk valuation scores are some of the result prediction models used in cardiac surgery. These models employ preoperative parameters to predict the postoperative outcome.(14)

It has been shown that intraoperative variables such as the amount of time CPB was kept on, the amount of time the aortic cross-clamp was kept open, the surgical technique used, and the levels of blood lactate are linked to postoperative morbidity.(11,15)

Cardiovascular surgery outcomes at Kafrelsheikh University Hospital were the focus of this investigation, which spanned 2018 and beyond. An overarching trend in cardiac surgery throughout time was more important than providing particular insights into groupings of procedures. In all, 428 operations were carried out during the research period, with 2023 seeing the highest annual case count of 103. From 2018 (n=41) to 2023 (n=103), the percentage of elective heart surgery operations has been continually rising.

The age of the participants in group 2018 was considerably lower than those in groups 2023, 2022, 2021, 2020, and 2019 (P value<0.001), which is the only group in this research where a significant difference was found. This is mainly due to increase in congenital surgery cases in 2018 by the aid of Emirati initiative to lower the waiting list of

congenital cardiac surgery patients. Sex was insignificantly different among the six groups. During the time period from 2013 to 2022, our research found no significant differences in age or sex amongst the groups that were evaluated.(16)

Each group's body surface area was almost identical. Our findings are at odds with those of Shah et al.,(2017)(17) who surveyed 39,982 patients treated for HF from 254 hospitals between 2005 and 2009. There was no statistically significant difference found in the study's demographic data. Some possible explanations for this pattern include gender-specific hormonal and genetic variations, as well as variations in environmental and lifestyle variables that raise the risk of cardiovascular disease.

According to the current study, Diabetes mellitus, hypertension, pulmonary hypertension and atrial fibrillation were with no statistically significant difference among the six groups. Ejection fraction was significantly lower in group 2023 and 2022 (P value <0.05) and this can be explained by the increase trend of our surgical team to accept more cases with low ejection fraction and other comorbidities. Shah et al.,(2017)(17) contradicted our results by conducting a retrospective study with multivariable models on cardiac patients to assess 5-year outcomes and compare survival to the median survival of the US population. They found that ejection fraction increased significantly from 2005 to 2009.

The incidence of redo procedures has significantly increased mainly in group 2023 and 2022. (p=.025). In our hospital the redo cases increased due to the progress and performance improvement of the surgeons. As regarding the laboratory data the was no significant difference between all groups.

With the exception of VSD and common AV canal, which were significantly higher in group 2018 (p<.001 and <.027 respectively) owing to more congenital cardiac surgeries in 2018 supported by the Emirati initiative at our hospital, no significant difference was seen in the kind of operation across all groups.

The 2020 Group had a much greater CABG rate than the other groups (p=.003). The MVR, AVR, and TVR levels were significantly greater in group 2023 compared to the other groups (p<.001). The AVR was much greater in the 2019 group compared to the others (p=.015).

We also notice that some types of operations were done in the last three years and not done before as off pump CABG, Bentall surgery, emergency stuck valve, emergency stab heart and tricuspid valve replacement. This reflects the improvement in our surgical team and paramedical staff that led to doing new and various types of surgeries in our hospital which require highly qualified surgeons and well-trained paramedical team. This also gave us the hope for dealing with emergency situations to be ready as planned in the near future. Aortic coarctation, pericardial window

and emergency stab heart, occurred in group 2023 and didn't occur in other groups. TOF occurred in group 2018 and didn't occur in other groups. Combined CABG and AVR, tricuspid valve replacement and pericardial cyst occurred in group 2022 and didn't occur in other groups.

As per Rodríguez et al., (2002)(18), out of 114 patients in our sample, 90% had CABG. Out of them, 5.5% had mitral valve replacement, 1.6% had aortic valve replacement, 0.8% had CABG+MVR, and 1.6% had CABG+AVR. Although the majority of patients requiring an aortic valve are over the age of 65, valve surgery continues to serve as the standard procedure for heart surgery. More people get sick or die from it, even if it doesn't seem that hard technically. In terms of volume, coronary surgery accounts for 45.4% of all surgeries, while valvular surgery accounts for the same percentage. In light of the fact that coronary surgery without CPB had better outcomes (4% mortality) than valve surgery (15.17%), it is incorrect to save cardiac surgery for elderly patients with valve illness. The usage of combination surgery, on the other hand, also showed an increase, although smaller. Combination treatments, as opposed to separate surgical operations, are expected to become even more prevalent in the years to come.(19)

Cardiac valve disease has historically been the backbone of the cardiac group, as may be seen from the progression of surgical illness. From 64% in 1989 to 77% in 1993, valve illness was the underlying cause of surgical indications.(20) Over the last seven years, coronary disease has been more common, and it is now more than 45.4%. While the rise of combined surgeries is noticeable, it is happening in smaller batches.(19)

Of all the valves operated upon, the aortic valve was the most common (61.6%). Next in line, with mitral disease at 18.9%, comes mitroaortic disease at 19.5%. The most common valvular lesion that led to surgical intervention was stenosis in aortic disease patients (90.3% of the total), whereas incompetence was the leading cause in mitral disease patients (61% of the total).(18)

Duration of surgery was significantly lower in the last three years (2023,2022,2021) (P value <0.001) and this reflects the improvement of surgical skills and good cooperation between surgical team individuals. This was achieved by the harmony between each individual of the surgical team.

The variation in duration of surgery not only depends on the skills of the surgeon but also on selection of cases as complicated cases take more time as Bentall procedure, triple valve replacement, redo surgery, multigraft CABG surgery and other perioperative factors.

Our results are in line with those of a prior retrospective clinical study conducted by Elkhouly, (2023)(21) on 80 patients aged 18 and above who had widespread LAD disease along with involvement of the right coronary artery, left circumflex artery, or any segment thereof. From 2017 to 2019, patients

were scheduled for CABG utilizing the cardiopulmonary system. Time spent in surgery was shown to reduce dramatically with time, according to their findings.

A study conducted by Zhang et al. in 2024 found that the amount of time needed for surgery reduced with time.(16)

Our findings revealed that type of cannulation was insignificantly different among the six groups. Custodial (Bretschneider) cardioplegia was significantly higher in all groups than group 2023 (P value<0.001) because the more use of delnido cardioplegia in 2023.

Aortic cross-clamp time and cardiopulmonary bypass time were significantly lower in (group 2023, 2022 and 2021) than (group 2020, 2019 and 2018) (p<.05) and this reflects the improvement of surgical skills and good cooperation between surgical team individuals. This was achieved by the harmony between each individual of the surgical team.

According to our results, Rodríguez et al., (2002)(18) conducted their 15 years retrospective study on patients undergoing cardiac surgery and reported that the Bypass and aortic cross-clamp times were minimized overtime the current study showed that the need for inotropes, bleeding, need for reopening, , superficial wound infection, deep wound infection, incidence of sternal dehiscence, mortality, hemorrhagic effusion, renal impairment, neurological impairment, chest infection, ARDS and transient ischemic attack were insignificantly different among the six groups.

As to the research conducted by Musharraf M et al. (2020) We observed that 93%of patients received blood transfusions after the procedure, 3% had arrhythmia, 2 percent developed renal dysfunction (post-operative creatinine>1.5), 1% had sepsis, and 71% had inotropes. Additionally, 2 percent had an intensive care unit stay of five days or more, and 1 percent had a hospital stay of eight days or more.

As a measure of the overall health of a population, the mortality rate may provide light on patterns and trends in this statistic. Also, our results showed significant decrease in MV duration, ICU duration, duration of hospital stay in the last three years (group 2023, 2022 and 2021) than (group 2020, 2019 and 2018) (p<.001) and this can be explained by improvement in perioperative care of patients including preoperative preparation, intraoperative team and postoperative care of patients.

Also, between 2017 and 2019, there was a considerable decline in the average duration of hospital stays and intensive care unit stays.(21)The typical length of stay in a hospital has been fifteen days, whereas that in a CSPU has been just five. The hospital stays over the last three years have averaged 13.8 days, whereas the CSPU stays have been 4.2 days.(18) There was no statistically significant difference in the mean length of hospital stays for patients undergoing valvular or coronary surgery (14.1 vs. 14.8 days)(18)

Our study reveals that mortality and morbidity are the same without significant difference ($p=.987$).

Death rates have followed a declining trend over time, which is in contrast to our findings. There was a 25% mean death rate in individuals with valve disease during 1985-1990, 20% from 1991-1995, and 13.3% from 1996-2001. The relative death rates for individuals undergoing coronary surgery were 20%, 15%, and 6.9%. The disparity in death rates between valvular and coronary surgery (1.2 vs. 1.3 and 1.9, respectively) is a reflection of the recent decrease in mortality rates among coronary patients (18)

Zhang et al., (2024)(16) studied neonates who had heart surgeries at one hospital between 2013 and 2022. They revealed 11.1% rate of mortality postoperatively in 2018-2022, compared to 29.4% in 2013-2017, ($p=.292$), indicating a decline in this complication. Surgery was also performed on a larger number of individuals. A notable decline in the rate of bloodstream infections was also seen, with 11.3% in 2018-2022, compared to 23.3% in 2013-2017.

Consistent with previous research by Thielmann et al. (2010)(22) and Vanhuysse et al. (2012)(23) a corresponding rise in the risk of complications—including postoperative bleeding, extended breathing, and deep wound infection—corresponded to this greater mortality. An examination of 939 individuals from 22 publications from 8 countries shown that there is a substantial rise in morbidity and death from CP class A to class C. Another article compiled the existing information to advise the therapy of these patients. (24)

The significant improvement in outcomes across procedure groups, even if the overall risk profile increased, may be seen as a sign of enhanced safety and quality. Various factors will unavoidably contribute to this tendency. Improvements in preoperative evaluation, interdisciplinary teamwork, surgical methods, and postoperative care are likely to have contributed. Rodríguez et al., (2002)(18) found that the mortality rate dropped considerably with time, which aligns with our findings.

There were 32 fatalities among 500 patients who had open heart surgery at Haseki Training and Research Hospital, according to our statistics. There was a 6.4% fatality rate.

Also according to our findings, the in-hospital death rate for cardiac surgery patients in the CICU was 9.1%. This rate was 6.4% for isolated CABG, 12.3% for valve surgery, 11.0% for patients treated with transplant or LVAD, and 11.0% for all other cardiac surgical operations. According to Kolh et al., (2001)(25) two separate risk factors for death in octogenarians after CABG were a reduced EF and emergency surgery. More than 70% of CABG patients over the age of 70 died from causes other than heart failure, according to the study. Limited to patients undergoing CABG alone, they discovered that deaths due to cardiovascular causes (cardiac arrest, ventricular arrhythmia, CVA) were significantly higher in patients with a higher NYHA functional

class, more urgent procedures, longer CPB, and a history of percutaneous aortic valvuloplasty in patients undergoing AVR.

The rate of death has been declining for some time. There was a 25% mean death rate in individuals with valve disease during 1985-1990, 20% from 1991-1995, and 13.3% from 1996-2001. The relative death rates for individuals undergoing coronary surgery were 20%, 15%, and 6.9%. The disparity in death rates between valvular and coronary surgery (1.2 vs. 1.3 and 1.9, respectively) is a reflection of the recent decrease in mortality rates among coronary patients. (18)

Although the ratio is larger in younger patients, surgical mortality has been decreasing in older patients in recent years. So, it seems like there was room for improvement in terms of death rates for this group. Surgeries performed without cardiopulmonary bypass improved outcomes for patients with coronary disease more than those with valvular disease, among other reasons. (18)

When we first began, we recruited highly competent academics from various institutions to form a cardiothoracic surgery department. Although our department encountered difficulties such as inexperienced paramedical staff and patients' lack of trust, which prolonged the process of patient safety measures, we were ultimately successful due to the increased expertise of our assisting healthcare personnel.

It is advisable that we shouldn't hesitate to build up new cardiac surgery centers with highly qualified surgeons and early experience paramedical staff. There has been a significant influx of cardiac patients requiring treatment at faraway institutions, prompting the need to establish an early cardiac surgery facility at Kafrelsheikh. Along with this number, the traveling time, frequency of follow-up visits, and financial strain on patients have all decreased significantly. Kafrelsheikh has heard rumors about potential regional heart surgery facilities that might better serve patients. Our findings also reported that there is increase in acceptance of more patients with comorbidities and surgery of difficult procedures as bentall procedures, off pump CABG, stab heart and valve repair.

We have seen a significant number of patients with diabetes, high blood pressure, pulmonary hypertension, and atrial fibrillation, all of which indicate an increased likelihood of negative consequences. However, we have managed to demonstrate that the keys to effective results at a recently established cardiac surgery institution are prompt surgical intervention, sufficient pre-operative care, and frequent follow-up. Our goal is not only to increase the number of operations, but also to increase the diversity of operations and to introduce new surgical methods to appropriate patients in the light of new developments.

CONCLUSIONS

In conclusion, this analysis shows that heart surgery outcomes have consistently improved from 2018 to 2023, even while patient risk profiles have increased. The results reflected the marvelous progress of the surgeon's skill in complicated surgical procedures. The death and morbidity rates are within acceptable ranges, due to the improvements in a number of quality indicators. The study includes all cardiac surgery operations conducted in Kafrelsheikh University Hospital. The surgical intensive care unit and paramedical team have improved, which led to better infection control.

RECOMMENDATIONS

It is advisable that we shouldn't hesitate to build up new cardiac surgery centers with highly qualified surgeons and early experience paramedical staff.

LIMITATIONS

The study had some limitations due to its retrospective design and the opportunity of missed data, incomplete records of patients, and it was a single center study with patient distribution not homogenous. Consequently, few statistical studies have been conducted to examine linear patterns across time.

Data pertaining to certain procedure groups will be published in a more comprehensive manner in the near future. Finally, the fact that practice affects the complex nature of mortality following heart surgery is widely established. A number of other variables may influence patients' outcomes that are not accounted for by the grading systems.

Recommendations

Further studies in other centers are recommended to compare findings. Additional studies with large follow-up periods are suggested. Good surgical outcomes with reduced morbidity and mortality are becoming attainable because of ongoing technological advancements, thorough patient preparation prior to surgery, and accurate overall assessment. Precise documentation of patient information (before, during, and after surgery). Establishing new cardiac surgery facilities with sufficient infrastructure and qualified personnel is critical for onsite service and cost reduction in healthcare. Establishing an early cardiac surgery center with professional surgeons and unexperienced paramedical staff is a valuable challenge that led to marvelous outcome.

Authors' contributions:

Ahmed Abd Elwahab Elsayed Hegazy: data collection, statistical analysis, and analysis of data. Mohamed Moustafa Abdelaal : administrative, technical, or material support and interpretation of data. Wael Mohamed El-feky : conception and design. , Amr A.

Abdou Ettish: supervision. All authors read and approved the final manuscript

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Availability of data and materials

The data underlying this article will be shared on reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate. The study was approved by the ethical committee of Kafrelsheikh University Faculty of Medicine. Written informed consent was obtained from all participants.

Consent for publication

A written consent was taken from every patient before enrollment in our study.

Competing interests

The authors declare that they have no competing interests.

References

1. Ciobanu C, Latimer S, Gillespie BM. Establishing a New Cardiac Surgery Service in an Australian University Hospital: Pitfalls and Lessons Learned. *Journal of Perioperative Nursing* 2018;31(3):35-45.
2. Taylor RS, Dalal HM, McDonagh ST. The Role of Cardiac Rehabilitation in Improving Cardiovascular Outcomes. *Nature Reviews Cardiology* 2022;19(3):180-94.
3. Pagano D, Kappetein AP, Sousa-Uva M, Beyersdorf F, Klautz R, Mohr F, et al. *EACTS Clinical Statement: Guidance for the Provision of Adult Cardiac Surgery*. *European Journal of Cardio-Thoracic Surgery* 2016;ezw300.
4. Mlambo M, Silén C, McGrath C. Lifelong Learning and Nurses' Continuing Professional Development, a Metasynthesis of the Literature. *BMC nursing* 2021;20:1-13.
5. Nilsen P, Seing I, Ericsson C, Birken SA, Schildmeijer K. Characteristics of Successful Changes in Health Care Organizations: An Interview Study with Physicians, Registered Nurses and Assistant Nurses. *BMC health services research* 2020;20:1-8.
6. Kinoshita M, Morioka N, Yabuuchi M, Ozaki M. New Surgical Scoring System to Predict Postoperative Mortality. *Journal of anesthesia* 2017;31:198-205.
7. Kivrak S, Haller G. Scores for Preoperative Risk Evaluation of Postoperative Mortality. *Best Practice & Research Clinical Anaesthesiology* 2021;35(1):115-34.
8. Ozturk E, Tanidir IC, Gunes M, Genc SB, Yildiz O, Onan IS, et al. The Effects of Vasoactive-Ventilation-Renal Score on

- Pediatric Heart Surgery. *Northern Clinics of Istanbul* 2020;7(4).
9. Gazit A. Outcome Prediction Following Complex Congenital Heart Disease Operations—the Intensivist Perspective. *Pediatric Critical Care Medicine* 2018;19(11):1083-4.
 10. Mehmood A, Nadeem RN, Kabbani MS, Khan AH, Hijazi O, Ismail SR, et al. Impact of Cardiopulmonary Bypass and Aorta Cross Clamp Time on the Length of Mechanical Ventilation after Cardiac Surgery among Children: A Saudi Arabian Experience. *Cureus* 2019;11(8).
 11. Patra C, Gatti PC, Panigrahi A. Morbidity after Cardiac Surgery under Cardiopulmonary Bypass and Associated Factors: A Retrospective Observational Study. *Indian heart journal* 2019;71(4):350-5.
 12. Stephens RS, Whitman GJ. Postoperative Critical Care of the Adult Cardiac Surgical Patient: Part II: Procedure-Specific Considerations, Management of Complications, and Quality Improvement. *Critical care medicine* 2015;43(9):1995-2014.
 13. Stephens RS, Whitman GJ. Postoperative Critical Care of the Adult Cardiac Surgical Patient. Part I: Routine Postoperative Care. *Critical care medicine* 2015;43(7):1477-97.
 14. Parolari A, Pesce LL, Trezzi M, Cavallotti L, Kassem S, Loardi C, et al. Euroscore Performance in Valve Surgery: A Meta-Analysis. *The Annals of thoracic surgery* 2010;89(3):787-93. e2.
 15. Kapadinhos T, Angelopoulos E, Vasileiadis I, Nanas S, Kotanidou A, Karabinis A, et al. Determinants of Prolonged Intensive Care Unit Stay in Patients after Cardiac Surgery: A Prospective Observational Study. *Journal of thoracic disease* 2017;9(1):70.
 16. Zhang H, Li G, Li Q, Zuo Y, Wang Q. Clinical Characteristics and Outcomes of Patients Who Underwent Neonatal Cardiac Surgery: Ten Years of Experience in a Tertiary Surgery Center. *European Journal of Medical Research* 2024;29(1):144.
 17. Shah KS, Xu H, Matsouaka RA, Bhatt DL, Heidenreich PA, Hernandez AF, et al. Heart Failure with Preserved, Borderline, and Reduced Ejection Fraction: 5-Year Outcomes. *Journal of the American College of Cardiology* 2017;70(20):2476-86.
 18. Rodríguez R, Torrents A, García P, Ribera A, Permanyer G, Moradi M, et al. Cardiac Surgery in Elderly Patients. *Revista Española de Cardiología* 2002;55(11):1159-68.
 19. Minja NW, Nakagaayi D, Aliku T, Zhang W, Ssinabulya I, Nabaale J, et al. Cardiovascular Diseases in Africa in the Twenty-First Century: Gaps and Priorities Going Forward. *Frontiers in Cardiovascular Medicine* 2022;9:1008335.
 20. Rodríguez R, Torrents A, García P, Ribera A, Permanyer G, Moradi M, et al. Cardiac Surgery in Elderly Patients. *Revista española de cardiología* 2002;55(11):1159-68.
 21. Elkhoully MI. Early Outcomes of Using Skeletonized Left Internal Mammary Artery (Lima) for Sequential Grafting of Multiple Left Anterior Descending Artery Lesions. *The Egyptian Journal of Hospital Medicine* 2023;91(1):3771-8.
 22. Thielmann M, Mehmet A, Neuhäuser M, Wendt D, Tossios P, Canbay A, et al. Risk Prediction and Outcomes in Patients with Liver Cirrhosis Undergoing Open-Heart Surgery. *European journal of cardiothoracic surgery* 2010;38(5):592-9.
 23. Vanhuysse F, Maureira P, Portocarrero E, Laurent N, Lekehal M, Carreaux J-P, et al. Cardiac Surgery in Cirrhotic Patients: Results and Evaluation of Risk Factors. *European journal of cardio-thoracic surgery* 2012;42(2):293-9.
 24. Wallwork K, Ali JM, Abu-Omar Y, De Silva R. Does Liver Cirrhosis Lead to Inferior Outcomes Following Cardiac Surgery? *Interactive CardioVascular and Thoracic Surgery* 2019;28(1):102-7.
 25. Kolh P, Kerzmann A, Lahaye L, Gérard P, Limet R. Cardiac Surgery in Octogenarians. Peri-Operative Outcome and Long-Term Results. *European heart journal* 2001;22(14):1235-43.