

Original article:

Cardiovascular surgery restart in COVID pandemic: challenges and solutions

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ABSTRACT:

Aims & Objectives: The objectives of this study was to discuss creating a hospital model in restarting cardiovascular surgery during Corona Virus disease-2019 (COVID 19) pandemic and to retrospectively analyze the early outcomes of patient operated during the study period under the modified policies of patient and hospital management.

Methods: a modified model of hospital and patient management was created in the department of Cardiothoracic & Vascular Surgery, GB Pant Hospital during the national lockdown for COVID-19. Patients admitted and undergoing cardiovascular surgery in between 01-06-2020 and 30-11-2020 were retrospectively analyzed on various parameters to evaluate efficacy of this modified model.

Results: Total 435 patients were admitted during study period, out of them 277 were operated. Valve replacement was the most common surgery performed in almost 60% of patients. There were total 30 mortalities in the admitted patients two being COVID positive mortality. None of the COVID negative patient who got operated, developed influenza like illness (ILI symptoms) till discharge. Total 20 health care workers including doctors, nursing staff, and auxiliary staff turned COVID positive during this study period .

Conclusion: COVID pandemic is a huge challenge for the health care system especially for cardiovascular speciality. A well planned and structured modification of existing hospital set up can result in, successful performance of cardiovascular surgeries under such conditions.

Key Words: COVID-19: Corona Virus disease 2019, AGPs: Aerosol generating procedures, ILI: influenza like illness, SARI: severe acute respiratory infection, PPE: personal protective equipments.

Introduction:

We all are well aware of extremely challenging time confronting the global medical community on account of Corona Virus disease-2019 (COVID 19) pandemic. Entire world is witnessing a bird swan event that is impacting most of established practices, norms and regulations. Our nation has also not been spared from the havoc which COVID 19 pandemic has unleashed over the globe. India underwent the largest lockdown which witnessed not only economic and social shut downs but also shutdown of the already overburdened health care system. With the unlock policy of the government has come an extra responsibility for the health care providers to plan & provide health care in a situation of rising COVID curve. Patients undergoing cardiovascular surgery are a unique population in this COVID-19 pandemic because of the risk of exposure to other from highly invasive, aerosol-generating procedures (AGP), the potentially prolonged hospitalization or ICU stay and the overall intense healthcare resource use. This observational study aims at creating a hospital model in restarting cardiovascular surgery during COVID-19 pandemic and to analyze the early outcomes of patient admitted & managed, under the modified policies of patient and hospital management.

Methodology:

This was an observational study which was conducted over the patients admitted during the ongoing COVID pandemic from 01-06-2020 to 30-11-2020.

A hospital model was planned and created during the national lockdown. Hospital blocks, Operating rooms (ORs), Intensive care units (ICUs) and wards were designated as COVID (Red) and Non COVID (Green). [Figures: 1 &2]. Well defined policy of patient admission, preoperative COVID testing, surgical technique and postoperative management was adopted in accordance with ICMR guidelines.

Following parameters of efficacy of hospital and patient management were analysed.

A. Parameters of efficacy of hospital management
1. Number of patients detected COVID-19 positive by RT- PCR in COVID-19 negative cardiovascular hospital.
2. Number of COVID negative admitted patients acquiring COVID-19 in admitted period.
3. Number of healthcare workers acquiring COVID-19 from Hospital.

B. Parameters of efficacy of patient management
1. Outcomes of surgery and conservative management (In COVID and Non COVID patients)
2. Perioperative complications in COVID and Non COVID patients
3. Mortalities during study period (In COVID and Non COVID patients)

Inclusion and exclusion criteria:

All patients admitted to cardiovascular wards from OPDs and emergencies during the study period managed surgically or conservatively were included for analysis. Refusal to consent for publication of personal data during the hospital stay was taken as exclusion criteria for the study.

Primary end point: Discharge after successful operative management was considered as primary end point.

Secondary end point: Any cause mortality, discharges before complete management (non consenting patients) transfers to COVID hospital were considered secondary endpoints.

Statistical Analysis:

Data was summarized and expressed in proportion for the qualitative variables and means, percentage, standard deviation (SD) and range for quantitative variables.

Results:

Total 435 patients were admitted since the beginning of unlock-1 in between 01-06-2020 and 30-11-2020 over a period of six months. Mean age of patients was 37.6 years. They comprised 253 males and 182 females. [Table –1]. Out of them 277 patients who agreed for surgery were operated. Most of these patients were highly symptomatic. Dyspnoea, chest pain and palpitations were the most common complaints. Most of those asymptomatic patients who refused for surgery due to perioperative risk of acquiring COVID infections were medically stabilized and discharged.

Analysis of the determined parameters of efficacy of hospital and patient management yielded following results.

Efficacy of hospital management:

Out of the 435 patients who were admitted after initial screening by history and later (starting from 15th September) by Rapid antigen test, 40 patients were found to be COVID positive by RT- PCR. These patients didn't have any history of COVID contact or symptoms suggestive of ILI. Out of these 40 COVID positive patients, 30 patients were screened negative by rapid antigen test (which was recommended late by ICMR in mid september).

Out of these 40 COVID positive patients, 38 patients (21 with stable valvular heart disease, 9 with chronic stable angina, 3 with asymptomatic OS-ASD, 5 with stable TOF patients) were transferred to COVID designated hospital, were treated there for COVID and discharged after getting COVID negative on RT PCR. Two patients found to be COVID positive in immediate postoperative period (One on the day of surgery and second on the day 1 of surgery). Other than these 2 patients, 4 more routine COVID negative patients found to be COVID positive although all these patients were completely asymptomatic in relation to COVID related symptoms. None of the emergency patients who got operated without RT- PCR test were found to be COVID positive on postoperative RT PCR testing. Routine RT PCR was done for health care workers who came in contact with COVID positive patients. Total 22 health care workers turn out to be positive during study period. [Table-1]

Efficacy of patient management:

Out of total 435 admitted patients 277 patients were operated and 158 patients were managed conservatively. Among the patients who were managed conservatively were patients with operated valve replacements with complications (deranged INR, stuck valves and CCF), patients who didn't give consent for surgery, and patients who were transferred to COVID designated hospital after found to be COVID positive [Table-2].

There were total 13 mortalities among these conservatively managed patients. First was the case of COVID positive operated mitral valve replacement with congestive heart failure came with dyspnoea, managed conservatively and expired before shifting to COVID designated hospital. Another was a case of operated mitral and aortic valve replacement who presented with stuck mitral valve in pulmonary edema. He was thrombolized for stuck mitral valve. There were bilateral lung infiltrates with suspicion of COVID infection but RT PCR came out to be negative. He expired on 3rd day of admission. 7 patients were post op case of valve replacement and were admitted with features of CCF, mostly presented with dyspnea and palpitation.

Valve replacement was the most common surgery performed in 60% of patients. Other surgeries which were performed were atrial septal defect closure, coronary artery bypass grafting, pericardiectomy ,thymectomy and Bentalls procedure, emergency left atrial myxoma excision, emergency right atrial myxoma excision, emergency Bentall's procedure, emergency aortic valve replacement, emergency embolectomy.

Operated patients had a mean invasive ventilation time of 6.5 hours and average day of discharge on 8th day. [Table-2] One patient had a prolonged ventilation time. He had aortic valve replacement for severe calcific aortic stenosis with severe Left ventricular dysfunction. Patient was preoperatively COVID positive and was operated 4 weeks after getting negative RT PCR report. Patient had cardiac arrest during sternal closure was resuscitated with open cardiac massage, put back on cardiopulmonary bypass and thereafter weaned. Patient keep on having

neurological issues in ICU and expired on day 7 because of intractable ventricular arrhythmia. Delayed protamine reaction & increased airway hyperactivity post COVID infection can be one of the possible reasons.

There were total 17 mortalities in operated patients. First mortality was a case of operated mitral valve replacement for severe mitral stenosis, left atrial clot with severe pulmonary artery hypertension. Patient had postoperative low cardiac output syndrome and developed renal failure. Lung showed bilateral infiltrates. Repeat RT PCR for COVID from tracheal aspirate was negative. Patient died on 10th postoperative day. Second mortality was a redo axillo bifemoral bypass. Patient was operated 6 years back for right axillobifemoral bypass. Patient was on oral anticoagulants which were discontinued during the lock down period. Patient presented with graft thrombosis with right lower limb gangrene. An emergency left sided axillo bifemoral bypass with above right knee amputation was done. Patient could not be revived from septic shock and died on 5th postoperative day. Third mortality was of case of operated embolectomy for femoral thrombus with severe mitral stenosis, left atrial clot with pulmonary edema. Post embolectomy patient developed left sided hemiplegia with cardiogenic shock due to probable thromboembolism. Patient died on first postoperative day. One patient of mitral valve replacement with giant left atrium died because of intractable ventricular arrhythmia in post op period. Two patients (One of post op CABG and another of post op mitral valve replacement) died because of post op hemorrhage. One patient of Morrow Procedure for HOCM died because of complete heart block and multiorgan dysfunction. 7 patients died because of intractable myocardial failure with low cardiac output syndrome leading to multiorgan failure. One patient died because of intracranial hemorrhage in immediate post op period. One patient of left atrial myxoma with 2 episodes of intracranial infarct in pre op period died because of low cardiac output syndrome leading to multiorgan dysfunction. One patient who was 80 year old, post op aortic valve replacement died because of respiratory failure. One patient of severe aortic stenosis suffered sudden cardiac arrest in pre op ward, patient resuscitated in emergency and after hemodynamic stabilization patient was taken for emergency aortic valve replacement. Patient kept in emergency ward for 3 post operated days and when day 5 COVID RT-PCR report turn out to be negative then she was shifted in elective post op ward. Patient ultimately died because of multiorgan dysfunction.

Total 435 patients were admitted since the beginning of Unlock-1 in between 01-06-2020 and 30-11-2020 over a period of six months. Mean age of patients was 37.6 years. They comprised 253 males and 182 females. Out of them 277 patients who agreed for surgery were operated. Most of these patients were highly symptomatic. Dyspnoea, chest pain and palpitations were the most common complaints. Most of those asymptomatic patients who refused for surgery due to perioperative risk of acquiring COVID infections were medically stabilized and discharged. Many of them included patients with stuck valves which were thrombolized and improved, patients who didn't give consent for surgery, and patients who were transferred to COVID designated hospital after found to be COVID positive. (Table-1) Valve replacement was the most common surgery performed in almost 60% of patients. There were total 29 mortalities in the admitted patients. 17 mortalities occurred in operated patients. First mortality was a case of operated mitral valve replacement with post operative renal failure. Patient died on 10th post operative day. Second mortality was a redo axillo bifemoral bypass who died of septic shock on 5th postoperative day. Third mortality was of operated embolectomy for femoral thrombus with severe mitral stenosis, left atrial clot with pulmonary edema. All these patients came out to be RT PCR negative. Two COVID positive mortality occurred. One in a patient with

previously operated mitral valve replacement who presented in congestive heart failure. 2nd patient was a preop case of RHD with severe mitral stenosis with severe tricuspid regurgitation with CCF. Another patient to expire was a case of operated mitral and aortic valve replacement who presented with stuck mitral valve in pulmonary edema. There were bilateral lung infiltrates with suspicion of COVID infection but RT PCR came out to be negative. (Table-1) Operated patients had a mean invasive ventilation time of 6.5 hours. One patient had a prolonged ventilation time. He had aortic valve replacement for severe calcific aortic stenosis with severe LV dysfunction. Patient was preoperatively COVID positive and was operated 4 weeks after getting negative RT PCR report. Patient had cardiac arrest during sternal closure was resuscitated with open cardiac massage, put back on cardiopulmonary bypass and thereafter weaned. Patient had neurological issues in ICU and expired on day 7 of surgery. Delayed protamine reaction & increased airway hyperactivity post COVID infection can be one of the possible reasons. Two patients came out to be COVID positive in immediate post operative period. None of the routine COVID negative patient who got operated developed ILI symptoms till discharges. And because of this exposure 4 doctors and 3 sisters of operative team turn out to be COVID positive. None of the emergency patients who got operated without RT PCR test were found to be COVID positive on postoperative testing. (Table-2)

TABLE 1: OUTCOMES OF PARAMETERS OF HOSPITAL MANAGEMENT UNDER THE MODIFIED MODEL

TOTAL PATIENTS ADMITTED		435
MALES		253 (58 %)
FEMALES		182 (42 %)
AVERAGE AGE		37.6 +/- 12 YRS
TOTAL PATIENTS OPERATED		277 (64 %)
TOTAL PATIENTS CONSERVATIVELY MANAGED		158 (36 %)
ADMITTED PATIENTS FOUND TO BE COVID POSITIVE ON DAY 5TH OF COVID RT – PCR TESTING		
PHASE - 1	WHEN RT-PCR WAS DONE DIRECTLY ON DAY 5 (FROM 1 ST JUNE TO 14 TH SEPTEMBER)	10
PHASE - 2	WHEN PATIENTS WERE ADMITTED AFTER SCREENING BY RAPID ANTIGEN TESTING (FROM 15 TH SEPTEMBER TO END OF NOVEMBER)	30
TRANSFERRED TO COVID HOSPITAL /DISCHARGED (FOR HOME QUARANTINE)		38
TOTAL MORTALITY IN COVID POSITIVE PATIENTS		02
TRANSFERRED,READMITTED AND OPEARTED		06

PATIENTS MANAGED CONSERVATIVELY /PATIENTS REFUSING SURGERY AND DISCHARGED/ PATIENTS EXPIRING DURING CONSERVATIVE MANAGEMENT(THESE PATIENTS WERE COVID NEGATIVE)	118
OPERATED EMERGENCY PATIENTS FOUND TO BE COVID POSITIVE POSTOPERATIVELY	00
COVID NEGATIVE ROUTINE PATIENTS ACQUIRING PERIOPERATIVE COVID	02
HEALTH CARE WORKERS ACQUIRING COVID INFECTION	
DOCTORS/NURSING STAFF/AUXILIARY STAFF	22
TABLE 2: OUTCOMES OF PARAMETERS OF PATIENT MANAGEMENT UNDER THE MODIFIED MODEL	
TOTAL PATIENT ADMITTED	435
DIAGNOSIS OF PATIENTS MANAGED CONSERVATIVELY	
POST VALVE REPLACEMENT DERANGED COAGULATION PROFILE	13
POST VALVE REPLACEMENT STUCK VALVES (THROMBOLYSED)	21
POST VALVE REPLACEMENT CCF	17
POST OP CASE OF CABG WITH ANGINA (LOW EF)	10
TOTAL	61
PATIENTS NOT CONSENTING FOR SURGERY (STABILIZED AND DISCHARGED)	
CORONARY ARTERY DISEASE, CHRONIC STABLE ANGINA	15
TETRALOGY OF FALLOT	06
ATRIAL SEPTAL DEFECTS	08
PATIENTS FOR VALVE REPLACEMENTS	17
TOTAL	46
DIAGNOSIS ROUTINE SURGERY	
CORONARY ARTERY BYPASS GRAFTING / CABG + MVR/AVR/DVR	23
MITRAL VALVE REPLACEMENT / MVR + TRICUSPID VALVE ANNULOPLASTY/ MVR + ATRIAL SEPTAL CLOSURE	99
AORTIC VALVE REPLACEMENT	32
DOUBLE / TRIPLE VALVE REPLACEMENT	35
ATRIAL SEPTAL DEFECT CLOSURE	23
LEFT ATRIAL MYXOMA EXCISION	03
BENTALL'S PROCEDURE	05
PERICARDIECTOMY	02

THYMECTOMY	03
BI-DIRECTIONAL GLENN SHUNT	01
VSD CLOSURE + AORTIC VALVE REPAIR	02
INTRACARDIAC REPAIR FOR TOF	14
VSD CLOSURE	02
PERICARDIAL CYST EXCISION	02
TOTAL	246
DIAGNOSIS EMERGENCY SURGERY	
EMERGENCY EMBOLECTOMY,PERIPHERAL BYPASS SURGERY,AV FISTULA	10
AORTIC VALVE REPLACEMENT	01
BENTALL'S PROCEDURE	01
RIGHT ATRIAL MYXOMA EXCISION	01
EMERGENCY CORONARY ARTERY BYPASS GRAFTING	01
STERNAL WIRE REMOVAL	14
PSEUDOANEURYSM REPAIR	03
TOTAL	31
POST OPERATIVE COURSE OF OPERATED PATIENTS	
AVERAGE VENTILATION TIME	6.5 +/- 2.6 HRS
PATIENTS WITH CHRONIC VENTILATORY DEPENDENCY /TRACHEOSTOMY	01
AVERAGE DISCHARGE TIME	8.5 DAYS
EARLY MORTALITY(UPTO POST OP DAY 10)	
POST OP TOTAL MORTALITY	17
MORTALITY IN PRE COVID TIME (6 MONTH)	47
MORTALITY IN COVID TIME (6 MONTH)	30
COVID MORBIDITY	
FOLLOW UP COVID POSITIVE PATIENT REQUIRING PROLONGED VENTILATION	02

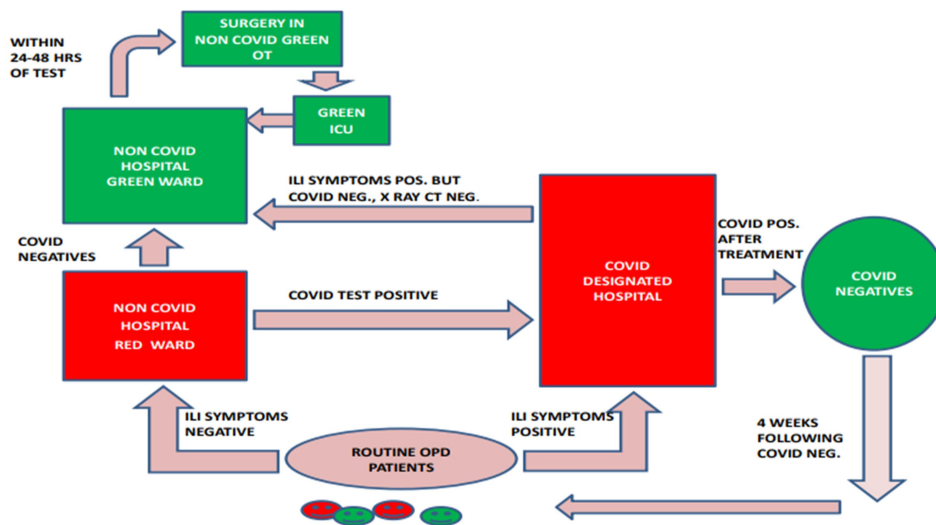


Figure 1: Protocol for management of routine cardiovascular patients

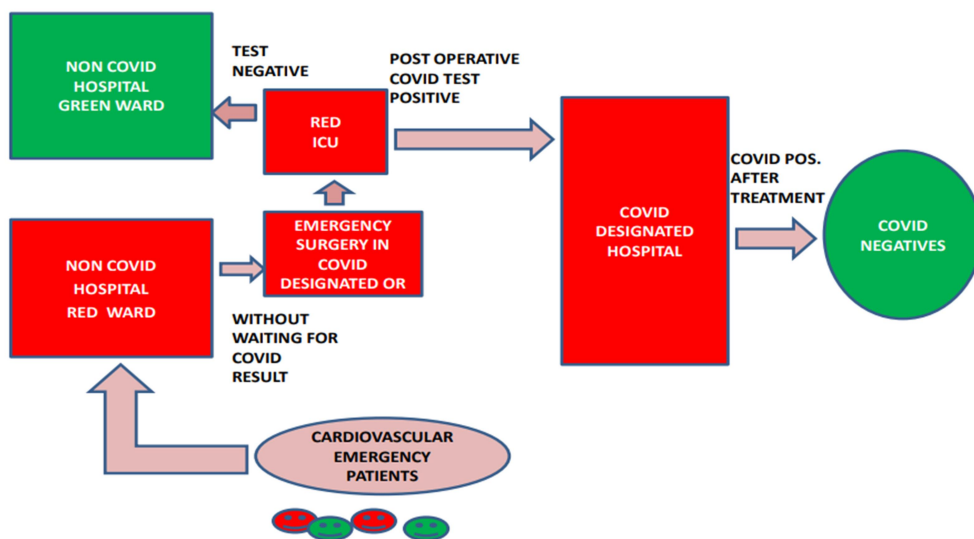


Figure 2: Protocol for management of emergency cardiovascular patient.

Discussion:

India witnessed its first COVID-19 case in January 2020[1]. Thereafter deadly disease engulfed the whole country with major metropolitan cities becoming the hot spots. National Capital Territory was one of the worst affected zones. Nationwide lockdown announced on 24 March 2020 limited the movement of entire 1.3 billion population for almost 3 months and was terminated with unlock-1 policy declared on 1st of June 2020. With the obvious benefits of flattening the early curve of the deadly disease, came the adverse effects of Lockdown. COVID-19 pandemic and subsequent lockdown exposed the existing gaps in the health care system of our nation. Unlocking posed biggest challenge for a speciality like cardiovascular surgery which now has to deal with the problems of accumulated sick patients awaiting major surgeries, confusing guidelines, hospital management, along with infection threat to healthcare workers. To operate in such scenario was another challenge. Early emerging data has shown a high mortality (34%) and morbidity rates for cardiac surgical patients acquiring COVID infection in perioperative period [2]. Cardiovascular surgery is one such speciality which frequently requires exploration of newer ways of functioning. Such unprecedented times demand us to reorient and reinvent our ways of functioning to combat existing situation. This study intends to share our early experience with restarting cardiovascular surgery after a period of slumber and modifications suiting a long list of guidelines which themselves are continuously evolving. Creation of new hospital models has been expressed as one of the key factor in fight against COVID pandemic [3]. Numerous models have evolved around the world. However very less data is available, how efficient these models are, in providing patient care without significant cross infection to patients and health care workers [4].

We at our hospital incorporated the following changes and policies in the existing system to provide patient care during ongoing COVID pandemic.

1. Separation of COVID designated and Non COVID designated buildings: Segregation of hospital buildings to COVID designated block and Non COVID block is an utmost important step in planning for functioning of health care services [5]. We at our hospital were able to do so after conversion of complete speciality hospital (LNJP Hospital) to COVID designated hospital sparing our cardiac and other super speciality hospital (GB Pant Hospital) as Non COVID one. Routine cardiovascular surgical patients without features of ILI or SARI were directly evaluated in Non COVID GB Pant Hospital. However those routine patients having ILI or SARI were referred to COVID designated LNJP hospital. These routine patients were referred back to GB pant hospital if found to be COVID negative on evaluation. [Figure 1] Policy for admitting cardiovascular surgical emergencies was different. Patients requiring emergency cardiovascular surgeries were directly admitted and planned for surgery at GB pant hospital with separate testing protocol. [Figure 2]. This separation of hospitals helped us a lot in preventing cross infection among admitted patients and we advocate the same.

2. Segregation of Wards in Non COVID hospital to COVID Suspicious (Red Zone Wards) and COVID Negative (Green Zone Wards): Ward in Non COVID GB Pant hospital providing cardiac surgical services were divided in to COVID suspicious wards (Red Zone) and COVID Negative wards (Green Zone) on different floors. Initial admissions from OPDs and emergencies were done to COVID Suspicious Wards. Patients found to be COVID negative were later on transferred from COVID Suspicious Wards to COVID Negative Wards. Those who were found to be COVID positive in COVID suspicious wards but requiring non emergency surgeries were transferred to

COVID designated LNJP hospital. However those found to be positive and requiring emergency surgeries were kept admitted in COVID wards and planned for operation in COVID designated OR. [Figures 1 & 2]

3. Segregation of Operation Rooms to COVID positive/suspicious (RED ORs) and COVID Negative (Green ORs): Similar to Wards cardiovascular Operating Rooms were designated as GREEN and RED. All operations on COVID negative patients were planned in GREEN ORs while those in patients with pending COVID reports, positive COVID reports or emergency surgeries without testing were done in RED ORs.

4. Perioperative testing policy for COVID-19 testing: Testing for COVID 19 was done as per the institutional policy in accordance with ICMR and NCT guidelines. Real Time RT-PCR was considered as gold standard test for detecting cases of COVID-19 as has been recommended by ICMR [6]. Initially all routine patients admitted to Red Zone Wards were observed for 5 days for symptoms suggestive of ILI or SARI. RT PCR test for COVID 19 was sent on 6th day. Patients found to be negative on RT PCR were transferred to Green Wards and were operated within 72 hours of the test report. Those reported as positive were transferred to COVID designated hospital. With the introduction of Standard Q COVID-19 Ag rapid antigen detection test (which started from mid of September), report of which could be received within 30 minutes all routine patients were initially screened on the day of admission and directly admitted to GREEN ward if found to be negative. This test was supplemented with RT PCR test just 24-48 hours before surgery. Standard Q COVID-19 Ag rapid antigen detection test has a very high specificity from 99.3 to 100% with sensitivity from 50.6% to 84% depending upon the viral load of the patient [7].

5. Anaesthesia considerations: Given the possibility of false negative testing (10-30%) the American Society of Anaesthesiology recommends that all anaesthesia professionals should utilize PPE appropriate for Aerosol Generating Procedures (AGPs) for all patients during the current pandemic [8].

At our institute all the routine cardiovascular surgical procedures were performed on COVID negative patients. Yet all AGPs were done considering possibility of false negative results. Masks, eye protection shields and PPE gowns were used during such procedures. Inductions and endotracheal intubations were especially performed by experienced anaesthetists to ensure first pass intubation. At the time of intubation minimal staff was kept inside ORs. Video laryngoscopy though recommended could not be routinely used in our patients. Pre-oxygenation with 100% inspired oxygen was done and bag-mask ventilation was avoided unless absolutely necessary.

6. Surgical Considerations: In view of reports of asymptomatic COVID carriers [9] and high mortality in patients with perioperative COVID infection [2] an exhaustive informed consent was obtained from all patients. This included consent for increased risk for postoperative ventilation, respiratory and renal failures and increased mortality rates in view of ongoing COVID-19 pandemic [2]. As a result a large number of patients especially those with minor symptoms refused surgeries. Preferably surgeries were performed by senior surgeons to reduce OR exposure time. OR doors were kept mostly closed during surgery to keep OR pressure and air exchange regulated. Number of OT staff was kept minimal. All OR staff practised enhanced droplet and contact precautions in the operating room at all times as per recommendations [10]. This included the use of masks, eye protection shields and PPE gowns. Eye protection shields were found to be difficult to adjust with surgical loupes and headlights and were not used by most surgeons especially when loupes had to be worn during micro vascular work. Acquiring COVID-19 infection from conjunctival exposure is disputed [11] although we recommend use of face shields if comfortable

for the operating surgeon. Use of smoke evacuating electrocautery was minimized to reduce exposure to surgical smoke . During coronary artery bypass grafting use of blower was minimised. Donning and doffing was carefully done and simulation training was given to all health care workers in this regard. Following the standoff period, the OR suite was cleaned using routine procedures with EPA-approved hospital disinfectant. Mostly either single case was done in the OR, or if second case was to be done OT was fumigated and closed for an appropriate standoff period to achieve adequate aerosol clearance.

7. Postoperative Care: Recommendations are there that cardiac surgical patients, in the current scenario should preferably recover in a negative pressure isolation room [8, 12]. ICU AGPs like endotracheal suctioning, intubation, extubation were done with due precautions. These AGPs in emergency operated patients in which proper testing protocols could not be followed were not performed without PPE kits. Policy for early extubation was considered whenever feasible. Outcomes of our hospital model and its comparison with existing data available: Till the completion of six months of adopting a new hospital model and starting cardiovascular surgery we have admitted 435 patients, 158 of these were managed conservatively and 277 patients were operated. Number of patients visiting the hospital and those consenting for surgery was initially dismal. Reasons were difficulties in interstate and within state travels and fear of acquiring perioperative COVID infection. Especially concerning was, low rates of parents consenting for paediatric cardiac surgeries. However numbers of admissions and surgeries is continuously rising. There are reports of markedly reduced cases of cardiovascular surgery across the country even at high volume centers corresponding with our study [13]. Efficacy of emerging hospital models is their success in providing previous surgical outcomes without significant rates of COVID cross infections to admitted patients and healthcare staff. Preventing mixing of COVID negative and positive patients is an important aspect of hospital management in current scenario. We used positive ILI history, history of contact, thermal scanning and later on rapid antigen test as method of screening to avoid admitting a non emergency COVID positive cardiovascular case to our COVID negative hospital. This screening failed in preventing 30 patients from getting admitted till now, who were detected COVID positive on RT PCR. So out of 435 patients 30 patients who were screened using rapid antigen test (which was recommended later by ICMR) was found to be positive by RT PCR on day 5 of admission. Reports are there of a large number of asymptomatic COVID carriers which can be potential COVID spreaders [9]. But in our study, none of the routine COVID negative patient who got operated or managed conservatively developed ILI symptoms till discharge. Although two of our patients came out to be COVID positive in immediate post op period . First patient was a pediatric case , planned for intracardiac repair for TOF. RT PCR report of day 5 was negative. On day 7, the day of surgery ,somehow RT PCR of same child get sent because of confusion in name. On the 7th day child underwent surgery (on the basis of day 5 negative COVID report),and in evening his day 7 report found to be COVID positive. Another patient(young female of 30 years) operated for mitral valve replacement in same operation theatre on same day (after fumigation) came out to be COVID positive on day 1 of surgery .Then both the patients transferred to emergency ward (RED ZONE) and then both the patient discharged on day 8th and 7th post operatively without any complication post op period .Because of this exposure 4 doctors and 3 nursing staff of same operative team turn out to be COVID positive. Although all of them were in hemodynamic stable state. None of the emergency patients who got operated without RT PCR test were found to be COVID

positive on postoperative testing. Cardiovascular surgery in COVID positive patients and recovered COVID positive patients carry a high risk of perioperative mortality and morbidity [2]. We in our modified hospital model made a policy of deferring surgery in a COVID positive routine cardiovascular case and in recovered COVID positive case up to 4 weeks. Till now We had operate 6 patients who were diagnosed COVID positive 4 weeks back .Detailed workup of these patients were done including HRCT thorax . and all the investigations were found to be in within normal range. cardiovascular emergency for which we have designated separate OR. One recovered COVID case has been operated for Aortic valve replacement, who had cardiac arrest during sternal closure was resuscitated with open cardiac massage, put back on cardiopulmonary bypass and thereafter weaned. Patient develop neurological issues in ICU and died on day 7 of surgery. There are reports of large number of healthcare workers acquiring COVID infection during this ongoing COVID pandemic [14]. Worst part is high mortality among healthcare workers [15]. We at our institute followed the policy of exhaustive precautions as mentioned earlier to prevent such situation. Till now we have 8 doctors, 12 nursing staff and two auxiliary staff turning COVID positive. 7 of them came in contact with COVID positive patient but for other contact could not be traced. All of the these health care staff is healthy and hemodynamic stable.

Conclusion:

Authors hereby conclude that COVID pandemic is a huge challenge for the health care system especially for cardiovascular speciality. Cardiovascular surgical services across the country, ultimately has to open up even though COVID curve is on rise. Providing good surgical outcomes along with preventing perioperative COVID cross infection to patients is of utmost significance and is possible by proper segregation policy. Health care workers acquiring COVID is huge concern and can be prevented by adopting proper PPE guidelines.

Limitations of study:

Major limitation of our study was shortage of health care staff to completely segregate two teams for RED AND GREEN ZONE. Study aims at sharing our early experience of creating a model of hospital and patient management during ongoing COVID pandemic and in coming time more data may be available which can be better analyzed. There is no significant published data available with which outcomes can be compared.

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