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SURGERY IN GROWN UP ADULTS WITH CONGENITAL HEART DISEASES – A SINGLE CENTER EXPERIENCE OF A DEVELOPING NATION

Cardiology

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ABSTRACT

Background:
The objective of this study is to report institutional experience with the surgical treatment of Grown Up Adults with Congenital Heart defects (GUCH) or Adults with Congenital Heart Defects in identifing demographic characteristics of Lesions, their immediate Surgical Postoperative outcomes and Mortality.

Methods
924 consecutive GUCH patient's records were retrospectively reviewed and data analyzed underwent cardiac surgery with or without cardiopulmonary bypass (CPB) from the age of 15 years or older at NIMS Hospital over the period from January 1, 2005 to December 31, 2015.

Results:
The median age of our patients is 28.76±12.09, with male: female ratio nearly equal. CPB time-90min±53. Aortic cross clamp time-45min ±33. Most common Acyanotic Lesion is ASD and Cyanotic Lesion is TOF. The predominant number of patients presenting for surgery belong to 15-20 years 313(33.87%). 60% of Complex Lesions present before 20 yrs of age. 49.8% patients were in NYHA Class1, 40.8% were in class 2, 8.7% were in class 3 and rest in class 4. Except for 12 cases, rest all were elective procedures. 78 cases (8.44%) had previous surgeries—38 previous Sternotomies and 40 thorcatomies. 96.75% (n=872) had complete surgery. Postoperative complication rate was 21.86%. Cyanotic patients had more serious postoperative complications and longer hospital stay compared with acyanotic patients The Mean ICU Stay varied from less than a week to 18 days. The Mortality is 1.5% (n=14).

Conclusion: Despite the long term deleterious effects of CHD in adult patients, surgical correction can be achieved with low mortality and acceptable morbidity. There is a need to provide continued highly specialized care.

KEYWORDS

adults, heart defects, congenital, cardiac surgery outcome assessment, GUCH, ACHD.

INTRODUCTION:

The issue of grown-up congenital heart (GUCH) patients, there needs and problems were highlighted by 32nd Bethseda conference [1] who are aged 16 years and over with congenital malformations of the heart and great vessels. The clinical profile of ACHD/GUCH in low-income countries differs from that of the developed world due to the lack of appropriate pediatric CHD structures and insufficient economic resources with most of the diagnosis and presentation being made later in life due to lack of access to surgery in childhood.This spectrum includes Infants with critical heart disease would not be expected to survive into adulthood without appropriate intervention, while natural survivors with less severe disease would often present late with the sequelae of cyanosis, pulmonary vascular hypertensive disease, infective endocarditis, and severe cardiac dysfunction . Also included are those with success in managing infants and children with congenital heart disease (CHD) has led to an emerging population of adult patients coming back for Redo or complications of previous surgeries(19). The complex anatomy and altered physiology makes a simpler surgery at earlier ages it an ardous task in perioperative period, technically demanding and taxing when done at later ages. The study is carried out in determining Surgical Outcomes of adults undergoing congenital heart surgery as studies to which are limited in Indian subpopulation. The overview of our 11years experience with more than 924 operations of adults with CHD at our institution was done for contemplation and planning the special requirements needed in health care for this very specific group.

Patients and Methods:

924 consecutive GUCH patient's records were retrospectively reviewed and data analyzed underwent cardiac surgery with or without cardiopulmonary bypass (CPB) from the age of 15 years or older at NIMS Hospital over the period from January 1, 2005 to December 31, 2015. Medical charts, anaesthetic records, and operative records were retrospectively reviewed & Data was analyzed describing the most common operations, patient characteristics, Surgical Complications and immediate postoperative outcomes.

Results:

Guch Trends:

The decresing trend in number of patients who were undergoing surgery of GUCH group is the result of increasing number of interventional catheterization procedures in a subset of patients like ASD and VSD, PDA concomitantly with Surgery. Device closures since 2009 with Increasing number of private sector participation with Governmental Health Insurance Schemes since 2007.Despite this the complexity of Procedures done is increasing be it complex lesions of Heart or redo procedures. GUCH Cases form 8% of all cases of cardiac surgery done at NIMS.

Table 1 GUCH Diagnosis

Diagnoses				Number	Patients
Septal defects	Atrial septal defect	Secundum		487	534
		Sinus venosus		33	
		Primum		12	
		Coronary sinus		2	
	Ventricular septal defect	Sub Aortic		30	84
		PeriMemb VSD		41	
		SubPul VSD		3	
		Muscular VSD		2	
	AV Canal Defect			8	
Left heart lesions	Aortic valve	Stenosis	Subvalvular	10	123
			Valvular	50	
			Supravalvular	1	
		Insufficiency		8	
		Aneurysm of Valsalva sinus		19	
	Mitral valve (insufficiency) + SubMitral Aneurysm+ Cortriatrium			35	
Right heart lesions	Tetralogy of Fallot			71	130
	DORV			14	
	Tricuspid valve			18	
	Pulmonary valve			5	
	DCRV			22	
Single ventricle + Tricuspid Atresia				2+ 7	9
Thoracic arteries	Aorta	Coarctation of the aorta		6	24
		AP Window		1	

Age Distribution:
* The predominant number of patients presenting for surgery belong to 15-20 years 313(33.87%) followed by the 3rd decade (21-30years) is 271(29%).
* 60% of Complex Lesions,40% lesions with moderate complexity present before 20 yrs of age
* 40% lesions of simple complexity present in 3rd decade of life.
* 50% of mortality in our series is in 2nd decade (15-20yrs) (n=7).

Sex Distribution:
* 47.73% (441) are Male GUCH , and 52.27%(483) are Female,Nearly equal distribution through different age groups also
* Females preponderence is more in Lesions ASD, PDA, DORV, Ebsteins, Coaraction of Aorta, Sinus of Valsalva, Tricuspid atresia.
* Male preponderance is seen in lesions of VSD, DCRV, TOF, TGA, BAV, SAM, AAE, TAPVC.
* Females have 65% of simple, 22% of Moderate and 13% of complex lesions.
* Males have 61% of simple, 24% of Moderate and 15% of complex lesions.
* Mortality of females is 1.24% (n=6), and that of Males is 1.81% (n=8).
* 82.4% of Females belong to reproductive age group between 15-35 years, who are in the age of getting married and into active sexual reproductive life, who need counselling regarding marriage, contraception and Pregnancy.

Complexity of Lesions:
* 63% (n=582) are simple lesions, 22.7% (n=210) are moderately complex and 14.1(n=130) are Complex Cardiac lesions.
* 60% of Complex Lesions,40% lesions with moderate complexity present before 20 yrs of age

Cyanotic and Acyanotic:
* 84% (n=778) of Operated patients were Acyanotic and 16% (n=146) were cyanotic.
* Predominant Cyanotic lesions is TOF 7.54% (n=71) followed by Ebsteins Anamoly 1.94% (n=18).
* Predominant Acyanotic lesions is ASD 57.9% (n=535), followed by VSD 8.23% (n=76) and BAV 5.41% (50).

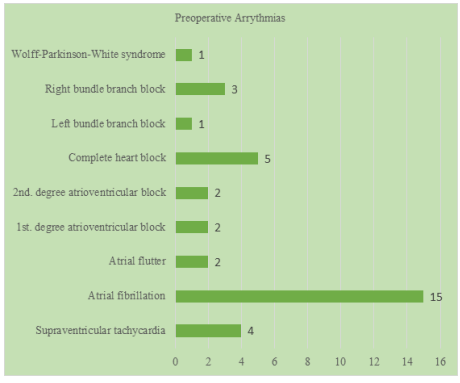
Preop NYHA Class:
* 49.8% (n=460) patients are in NYHA Class1, 40.8% (n=377) are in class 2, 8.7% (n=80) are in class 3,and 0.8%(n=7) are in class 4.
Presenting Complaints:
* The presenting complaints of most of the patients in this series are Shortness of Breath on exertion 50.22% (n=464), Palpitations 8.66% (n=80), Chest Pain 6.17% (n=57), Cyanosis 15.80% (n=146) , and Syncopal or Arrythumias.
* History of Headache or migraine was given in ASD patients.

Table 2 RISK FACTORS PREOPERATIVE

Cardiopulmonary resuscitation	3
Preoperative complete heart block	5
Shock, persistent at the time of surgery	2
Shock, resolved at the time of surgery	1
Diabetes mellitus Hypertensive Hypothyroid Hyperthyroid	1 5 6 2
Hepatic dysfunction	4
Endocarditis	5
Sepsis with positive blood culture	1
Stroke during lifetime	6
Seizures during lifetime (h/o of brain abscess	1
Renal dysfunction	2
Renal failure requiring dialysis	1
Other	
Severe pulmonary artery hypertension Coronary artery disease	5
Severe cardiac dysfunction	4

Preoperative Risk Factors:
* 5 patients had Infective Endocarditis of Aortic Valve, 2 in Tricuspid Valve, 1 in Pulmonary valve and Right Ventricle each. 1 patient had cerebral abscess which was drained and had sequlae of Seizures.

Arrythmias:
* Most of elderly patients had Atrial fibrillation.
* Ebsteins patients were predominatly having Complete heart block or 1st degree block or WPW syndrome.
* 2 patients had history of Transient Ischemic Attack or CVA following Embolisation in Atrial Fibrillation Patients.



Nature of Surgery:
11 cases (1%)were done on emergency basis and the rest were elective cases. 7 cases were due complications of Cardiac interventional procedures in Cath lab either due to slippage of ASD Device closure or PDA Device slippage.

Previous Sternotomies:
38 (4.11%) patients had previous sternotomies.1 patient underwent Thrice.

Previous Surgeries:
78 cases (8.44%) of series had previous surgeries—38 previous sternotomies and rest 40 were thorcatomies for either palliative surgeries (MBT Shunt for TOF or DORV) or Definitve repair (PDA).

Palliation/Repair/Reoperated:
96.75% (n=872) had complete repair, 2.60% (n=24) had reoperations, 3.03% (n=28) had palliative surgeries.

Postoperative Complications:
Patients requiring Blood and Blood Products for bleeding in excess of 4 pints is 8% (n=74) belong predominatly to TOF and DORV group followed by BAV surgeries probably due to clotting dysfunction in cyanotic patients and Aortic Surgeries. Bleeding requiring reoperation is seen in 4% (n=37) of cases predominatly seen in TOF; as a result of which these cases were kept sternum open on POD 0 and closed on the next day.

Renal failure requiring dialysis was seen in 2% (n=19) cases. 1% (n=10) of cases had medistinitis or wound infection. Low cardiac output was seen in 6% (n=55), 1% (n=10) of cases had focal defecits or seizures.

Atrial Fibrillation postoperatively is seen in 7% (n=65) of cases predominatly seen in ASD Closure and older age groups and Post Fontan group in Tricuspid Atresia.AV Block requiring permanent pacemaker was used in 1% of cases predominatly in Ebsteins, VSD, AVCD patients.

* 6%(n=55) of had prolonged pleural effusion requiring ICD for more than 5 days seen more in Fontan patients. 3% (n=28) had pericardial effusion, 4% (n=37) had postoperative LRTI, 2% (n=19) had Mechanical ventilation for more than 7 days were either patients of low cardiac output or ARDS or had Seizures or CVA.

ICU Stay & Hospital Stay
The Mean ICU Stay varied from less than a week to 18 days.

Mortality:
The Mortality is 1.5% (n=14).11% (n=2) for cases off Ebsteins,7.14%

(n=1) for cases of DORV,6.25% (n=1) for cases of PDA and TGA each,2.82%(n=2) for cases of TOF, 2.63%(n=2) for cases of VSD ,2%(n=1) for cases of BAV, 0.56%(n=3) for cases of ASD,1 case of Single Ventricle.

Mortality of females is 1.24% (n=6), and that of Males is 1.81% (n=8). 50% of mortality in our series is in 2nd decade (15-20yrs) (n=7). 50%of mortality of series are complex lesions, 21% simple, 28.5% are of moderate complexity.

Comment:

Study Limitations

- The principal limitation of this series is it being a retrospective study not all data was avaliable from all case sheets.
- Secondly lack of data regarding follow up of these patients after discharge about complications faced, incidence of arrythymias, morbidity and mortality. Data is being collected regarding these in determining factors affecting Morbidity and Mortality of these patients.
- Thirdly this group of patients are heterogenous group and vary in complexity among same lesions comparisions are not homogenous.
- The introduction of transcatheter interventional cardiology procedures during the latter stages of the study period would also have influenced the patient population operated on, with less complicated patients being referred for percutaneous intervention.

Comparsion of Developed and Developing Countries:

Congenital heart disease (CHD) is the most common type of congenital abnormality and has a prevalence of 8–10 per 1000 live births. In most developed countries where facilities for cardiac surgery are available, more than 90 % of children survive to adulthood. In these countries, the number of adults with CHD exceeds the number of children with CHD in these countries. Since most CHD are not completely correctable, lifelong care by experts is necessary even if one or more interventions have been done. The need to provide care for adults with CHD was recognized long ago in developed countries, resulting in the establishment of specialized services and clinics for adult CHD patients. These services are run by trained adult CHD specialists who are well versed with specific issues in un-operated as well as in post-intervention patients. Further improvement in adult CHD care has been contributed by several publications on management guidelines and position statements from expert groups in these high-income countries.

However, 80 % of children with CHD are born in developing countries where facilities for cardiac surgery are either very sparse or completely nonexistent. Since a significant attrition occurs during childhood due to serious CHD, the number of adults with CHD in these countries is likely to be much lower. Most surviving adults have one of the milder lesions. Only a small proportion consists of patients with severe and complex CHD who were operated in infancy and childhood. Another small pool is formed by patients who are exceptional survivors despite having a complex CHD and no intervention. There was a significant number of redo surgeries in developed countries which is more than >40% while that in developing countries and our study is below 10%. The disease profile and patient characteristics are very different in developing and developed countries for adults with CHD. Over 90 % of adults with CHD living in high-income countries have undergone one or more interventions during infancy or childhood. The intervention-naïve group consists of patients with mild forms of CHD. In contrast, more than half of the adult CHD population has never undergone any intervention in developing countries as a result of which redo cases were lesser compared to developednations. Only 14 % of adults with CHD had cardiac surgery in an outpatient population of a government hospital in New Delhi, India. In China, over 50 % of adults with CHD have never been treated.

Surgeries or Interventions for Arrythymias are done in these developed countries where such facilities for these are at expense in developing nations.

The median age of our 924 patients is 28.76±12.09 which is lesser than rest of other studies except Usman Ali etal that from developing country Pakistan; while the rest of studies come from developed countries where facilities are better avaliable and undergo surgeries at an earlier age and come back for redo surgeries at adult stage. Morever this study encompaases all patients above 15 years while rest of studies take ages 16 years or 18 years and above.

The male: female ratio is nearly equal in all studies ,be it developed or developing countries; this also shows most of these patients come in their active reproductive age group ,who needs counselling regarding marriage , sexual life. The CPB time and Aortic cross clamp time is nearly equal in all studies compared to present study, which indicates standard operating procedure being followed. The number of Repairs done is more than the rest of studies and the redo surgeries is far lesser than the rest of studies only indicating the presentation of cases is directly much in adulthood in developing countries especially Left to Right shunts (ASD,VSD) or TOF compared to Developed countries where facilities for early operation are avaliable and these patients come for redosurgeries later in adulthood.

The postoperative complication rate in our study is 21.86% (456 complications /202 patients) which is comparable to rest of other studies shown in Table 6 .The mean ICU Stay is higher than the rest of studies although the mean Hospital stay after surgery is comporable to other studies because the mean ICU stay for any patient in our set up is 2-4 days which is nearly good as we don't have a step down.

The operative mortality for adults with CHD is over 15–20 % in developing countries as compared to under 5 % mortality in children with CHD. The actual figure may even be higher as mortality is often under-reported. Higher mortality stems from late presentation leading to long periods of uncorrected hypoxia, pulmonary vascular disease, ventricular dysfunction, aorto-pulmonary collaterals, etc. The post-operative course and the long-term morbidity is also higher in adults as compared to children. A lower mortality and morbidity for adults with CHD is reported from developed countries due to the availability of specialized care centres with well-trained staff. However, our series reported lower in hospital mortality of 1.51%, which may be due to lesser complexity of lesions being operated. The Mortality rate in early Postoperative period or in hospital mortality is 1.51% (14) which is comparable to rest of other studies, which usually are Presenting in emergency or complex congenital disorders or late presentation which are borderline Eisenmengers with severe PAH.

Comparsion with other Developing Countries:

In developing nations, a significant proportion of adults with un-operated CHD develop complications related to long standing pulmonary hypertension, hypoxia and ventricular dysfunction. These complications may either totally contraindicate any intervention or makes the intervention high risk. The disease profile and patient characteristics are very similar in developing countries for adults with CHD Atrial septal defect is the most common abnormality, seen in 20 to 53 % of adults with CHD . This is not surprising since an atrial septal defect can remain undiagnosed due to lack of symptoms in the majority. The next common defect is ventricular septal defect, followed by pulmonary stenosis and other milder forms of acyanotic CHD. Tetralogy of Fallot was present in as many as 10 % of the adult CHD population in the data from Beirut, Lebanon while in our study it is 7.5%. Complex cyanotic CHD are rare, seen in less than 2 % of cases. These are exceptional cases where the cardiac haemodynamics is conducive to natural survival.

CONCLUSION

The complexity of congenital lesions and Redosurgeries is on the increase.Mortality and Morbidity for Cyanotic lesions is greater than Acyanotic lesions.Good results can be obtained with careful preoperative workup selection of patients, Principles of surgery and postop care with experience. The surgical management of GUCH is feasible with acceptable surgical outcomes in the setting of a tertiary referral center served by cardiac surgeons with expertise in congenital heart surgery with low mortality and acceptable morbidity.

GUCH Unit / ACHD Referral center to be started for provision of counselling, support, Marriage, Pregnancy.EPS unit to help these patients for early identification of fatal Arrthymias and Facilities for performing surgeries or interventions for Arrythymias. Early Identification and Good referral system with Training of Dedicated staff by providing accessible and quality health care with cost effective strategies helps in providing Better services. Form Protocols by perodic auditing of Health services helps in optimal and effective

utilization of disposed meagre resources.

Direct public institutions to frame programmes and services and provide funds for indigenisation of health services. All deaths and most significant complications are related to Cyanotic and Complex defects. There is a need to provide continued highly specialized care with heart and lung transplantation.

This study should also contribute significantly to our understanding of the needs of this patient group and facilitate planning for the future provision of cardiac services for this complex group of patients in a resource-poor environment. Resources, patients, and funding should be concentrated in a few designated centers – GUCH

'What is Already Known?' and 'What this Study Adds?'

GUCH patients presenting profile is presented in Indian studies has been published but This Study of GUCH undergoing surgery gives a surgical perspective of this sect of patients, a view of patients undergoing surgery ,intraoperative issues and post operative complications, a study not published so far from Indian series.

Table 3 Comparsion of Different Studies on GUCH Surgery.

Study	Institution	Centers	Country	Year of Study	Cases No
Annie & Somerville etal	Royal Brompton Hospital's	Single Center	United Kingdom	1991-1994 (5 years)	295
Stellin etal	Multicentered European	19 centers/ 13 countries	Europe	1997-2004 (7years)	2012
Andrew etal	Onassis Cardiac Surgery	Single Center	Greece	1997-2004(7years)	289
Jakob Klcovansky a etal	Rigs hospital	Single Center	Denmark	1998-2005(7years)	225
Abarban etal	University of Michigan	Single Center	USA	1998-2004(6yeras)	234/243
Putman etal	Erasmus university medical	Single center	Netherlands	1990-2007(17 years)	830/963
Verheugt etal	Dutch National Registry CONCOR	94 centers	Netherlands	2002-2008(6 years)	7414
Mascio etal	STS Database	58 centers	United States of America	2000–2009 (9years)	5265
Padalino etal	Multicentered Italian	7 centers	Italy	2001-2004(3years)	856/1179
Popelova etal	Hospital Na Homolce	Sigle Center	Czech	2005-2015(10 years)	805/844
Satoshi Kurokawa etal	Tokyo Women's Medical University	Single Center	Japan	2009-2011(3years)	92
Usman Ali Shah etal	Rawalpindi Institute of Cardiology	Single Centre	Pakistan	2013-2015(3years)	170
Present study	NIMS	Single Center	India	2005-2015 (11 Years)	924

Table 4Comparsion of preoperative variables of Different Studies

Study	Male	Female	Mean Age (yrs)	Cyanotic	Preop Rhtym Disorders	Age Group
Annie&Somerville etal	163(55.25%)	132 (44.75%)	31± 13	-	-	≥16yrs
Stellin etal	1005(50%)	1007(50%)	34.4±14.53		199(9.9%)	≥18yrs
Andrew etal	143(49.8%)	146(50.2%)	35 ± 13.6	12(4.2%)	34(11.7%)	≥18yrs
Klcovansky a etal	113(50%)	112(50%)	37 ± 16	-	-	≥16yrs
Abarban etal	115(49%)	119(51%)	30 ± 11	10%	18%(42)	≥18yrs
Putman etal	50.3%(417)	49.7%(413)	39.3±15.5	9%(86)	-	≥18yrs
Verheugt etal	3724(50.2%)	3690(49.8%)	35	-	-	≥16yrs
Mascio etal	2631(50%)	2634(50%)	25	-	14%	≥18yrs
Padalino etal	455[53.2%]	401 (46.8%)	37.2	-	-	≥18yrs
Satoshi Kurokawa etal	50(54%)	42(46%)	36.3±16.1	-	-	≥15yrs
Usman Ali Shah etal	91(53.5%)	79(46.5%)	22.85±11.6	20%(34)	-	≥18yrs
Present study	441(47.73%)	483(52.27%)	28.76±12.09	15.80%(146)	24(2.6%)	≥15yrs

Table 5 Comparsion of Lesions of Different Studies

	2005-15	1997-04	1997-2004	1998-2005	2013-15	2002-08	2000–09	1990-07	2005-15
Diagnosis	NIMS	Stellin etal	Andrew etal	Jakob etal	Usman Ali etal	Verheugt etal	Mascio etal	Putman etal	Popelova etal
ASD	535 (57.9%)	649	153	64	48.2%(82)	1267	33	36%(347)	153
VSD	76(8.23%)	108	16	12	15.8%(27)	1061	4	5.9%(57)	26
PDA	16(1.73%)	10	3	2	8.2%(14)	94	0	0.6%(6)	0
PS	5(0.54%)	33	4	6	0.5%(1)	549	4	2.9%(28)	51
DCRV	22(2.38%)	0	0	0	0	0	8	0.1%(1)	0
TOF	71(7.54%)	289	12	38	19.4%(33)	791	43	12.8%(123)	107
DORV	14(1.51%)	16	2	2	0		5	0.4%(4)	10
TGA	4(0.43%)	38	0	8	0	378	12	3.8%(38)	20
CCTGA	12 (1.2%)	35	0	8	0	96	9	0.8%(8)	8
EBSTEINS	18(1.94%)	27	4	6	0	125	9	3.2%(31)	47
MVP	30(3.25%)	37	7	3	0	71	0	0.2%(2)	59
BAV	50(5.41%)	153	6	10	0	419	0	16.8%(162)	139
CoA	6(0.64%)	69	17	21	1.7%(3)	756	7	8%(77)	23
RSOV	19(2.06%)	0	1	0	1.7%(3)	0	0	0	2
Tricuspid Atresia	7(0.75%)	0	0	0	0	65	3	1.9%(18)	0

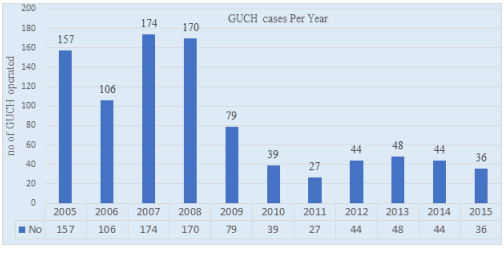
SAM\LVOTO	11(1.19%)	56	16	10	0	571	0	19.7%(180)	33
SMA	4(0.43%)	0	0	0	0	0	0	0	0
Marfan/AAE	8(0.86%)	50	16	1	0	380	0	3%(29)	49
TAPVC	3(0.32%)	7	2	0	2.4%(4)	99	0	0.3%(3)	0
SV	2(0.22%)	70	0	6	1.1%(2)	0	12	0.13%(13)	16
ALCAPA	1(0.11%)	0	1	0	0	0	0	0.3%(3)	3
AP Window	1(0.11%)	7	0	0	0	0	0	0	0
Cortriatrium	1(0.11%)	4	0	4	0	0	2	0	0
AVCD	8(0.86%)	131	22	21	0.5%(1)	125	10	6.1%(59)	46
others	3(0.32%)		3		0			TA-5(0.5%)	
Cases Number	924	2,012	289	225	170	7414	5265	830/963	844/805

ASD: Atrial Septal Defect,VSD:Ventricular sepatal Defect,PDA: Patent Ductus Arteriosis,PS: Pulmonary stenosis,DCRV: Double Chambered Right Ventricle,TOF:Tetraology of Fallot,DORV: Double outlet right ventricle,TGA: Transposition of great arteries, CCTGA: Congentially corrected Transposition of great arteries,MVP:Mitral Valve Prolapse,BAV:Bicuspid Aortic Valve;CoA: Coaracttaion of Aorta,RSOV: Ruptured sinus of valsalva,SAM/LVOTO:-Subaortic membrane/Left ventricular outlet obstruction,SMA-Submitral aneurysm,AAE: Annulo Aortic Ecatsia,TAPVC: Total Anamolous pulmonary venous return,SV: Single ventricle,ALCAPA: Anamolous origin of coronary artery from pulmonary artery,AP: Aortic Pulmonary,AVCD: Atrioventricular canal Defect.

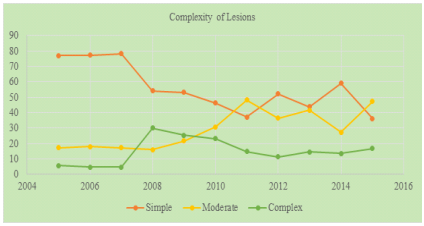
Table 6 Complications In Postopertive period:

Complications			
Bleeding Requiring Blood and Products	74(8%)	Cardiac arrest	18(2%)
Bleeding requiring reoperation	37(4%)	Pleural effusion	55(6%)
Renal failure requiring temporary dialysis	19(2%)	Pericardial Effusion	28(3%)
Wound infection/ Medistinitis	10(1%)	Pneumonia /LRTI	37(4%)
Low cardiac output	55(6%)	Reintubation	19(2%)
Atrial Fibrillation	65(7%)	Mechanical ventilation>7 d	19(2%)
AV block requiring permanent pacer	10(1%)	CVA / Seizures / Focal defecits	10(1%)
		Mortality	14(1.51%)

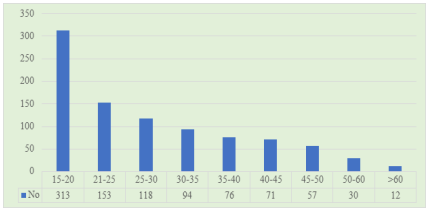
GUCH Cases operated year wise:



Complexity of Lesions GUCH :



Age wise distribution of GUCH Cases:



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