

CLINICAL STUDY

Adult cardiac surgery report 2021: The annual report from the Registry of the National Institute of Cardiovascular Diseases

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ABSTRACT

INTRODUCTION: Based on a longtime voluntary registry founded by the Ministry of Healthcare of the Slovak Republic in 2012 and endorsed by the National Institute of Cardiovascular Diseases, well-defined data of all adult cardiac surgery procedures performed during the year 2021 are analyzed.

MATERIAL AND METHOD: For this period, data on 947 procedures were submitted to the registry.

RESULTS: The unadjusted in-hospital survival rate for the 352 isolated coronary artery bypass grafting procedures including urgent and emergency procedures (relationship on-/off pump 3.8 : 1) was 96.3 %. For 331 isolated heart valve procedures (33 transcatheter interventions), it was 95.5 %. Concerning ventricular assist devices, 19 implantations were registered. In 2021 the number of isolated heart transplantations was 16, which is a decrease by 38.5 % as compared to the previous year.

CONCLUSION: These annually registered data are collected from voluntary public reporting and accumulate actual information on nearly all heart procedures carried out in the National Institute of Cardiovascular Diseases. These data capture advancements in heart medicine and represent the basis for quality management. In addition, the registry demonstrates that the provision of cardiac surgery in Slovakia is up to date, appropriate, and nationwide patient treatment is guaranteed all the time (Tab. 14, Fig. 2, Ref. 5). Text in PDF www.elis.sk

KEY WORDS: heart valve surgery, outcomes, coronary artery bypass grafting, aortic surgery, heart transplantation.

Introduction

Legitimate demands for a sophisticated quality management in medicine by authorities, scientific organizations, healthcare companies, and patients all over the world have stimulated the quality awareness. This resulted in the development of versatile quality assurance activities such as benchmark projects, public reporting and registries to answer those needs (1–3). In 2012, the Ministry of Healthcare of the Slovak Republic decided to set up a periodic data collection of all cardiac surgical procedures in form of a voluntary, unaudited registry (4). The prevalent aims of the latter set-up are to detect developments and upcoming trends in cardiac surgery in Slovakia while compiling various results for nearly all cardiac surgical procedures and facilitating the evaluation on an international level for the Slovak cardiac surgery.

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For monitoring actual conditions along with developments in cardiac surgery, the registry covers all relevant techniques and innovative technologies including minimally invasive cardiac surgery as well as all kinds of heart valve procedures, including transcatheter heart valve interventions.

Data and results presented in this report give a comprehensive insight into the development by comparing the 2020 and 2021 data.

Material and methods

Since 2012, the year of establishment of the register of the National Institute of Cardiovascular Diseases, specific data from all performed cardiac operations (structured questionnaire) are gathered periodically in a standardized way. All data are requested annually and are to be completed by March 31 of the next year. The recommended path for data export is an electronic transmission in form of an encrypted file. After the transaction, the data are decrypted, evaluated for completeness, and compiled for further analysis. Thus, the entire process ensures anonymity.

Inclusion criteria for the report were all cardiac procedures performed on patients between January 1, 2021, and December

Tab. 1. Frequency of cardiac procedures.

Category	Male		Female	
	n	%	n	%
Isolated CABG	292	83	60	17
Isolated heart valve procedures	149	72.3	57	27.7
CABG+heart valve procedures	42	77.8	12	22.2
CABG+other procedures	51	86.4	8	13.6
Heart valve procedure+other procedures	99	61.9	61	38.1
CABG+heart valve procedures+other procedures	18	78.3	5	21.7
Other	65	69.9	28	30.1

CABG = coronary artery bypass grafting, HTx = heart transplantation

Tab. 2. Gender distribution.

Category	With ECC	Without ECC	Total	Diff. 2020 (%)
Isolated CABG	278	74	352	-12.2
Isolated heart valve procedures	171	35	206	-10.8
CABG+heart valve procedures	53	1	54	-15.6
CABG+other procedures	53	6	59	37.2
Heart valve procedures+other	157	3	160	7.4
CABG+heart valve procedures+other	23	0	23	-14.8
Other	81	12	93	-12.3
Total	816	131	947	-7.2

CABG = coronary artery bypass grafting, ECC = extracorporeal circulation

Tab. 3. Additional data 2020 vs 2021

All procedures	2020	%	2021	%
Redo	79	7.7	128	62
Urgent	113	11.1	140	23.9
Emergent	52	5.1	40	-23.1

Tab. 4. Isolated heart valve procedures (including MAZE).

Procedure	n	†	%
Single valve	254	9	3.5
Double valve	66	4	6.1
Triple valve	11	2	18.2
TAVR	24	1	4.2
TMVR	9	1	11.1
Total	331	15	4.5

TAVR = transcatheter aortic valve replacement, TMVR = transcatheter mitral valve replacement

Tab. 5. Single heart valve procedures (including MAZE).

Access path	n	†	%
Aortic valve			
Sternotomy	149	6	4
Partial sternotomy	4	0	0
Conversion from partial sternotomy	0	0	0
Transapical TAVR	24	1	4.2
Mitral valve			
Sternotomy	62	1	1.6
Transapical TMVR	9	1	11.1
Tricuspid valve			
Sternotomy	3	0	0
Pulmonary valve			
Sternotomy	3	0	0
Total	254	9	3.5

TAVR = transcatheter aortic valve replacement, TMVR = transcatheter mitral valve replacement

31, 2021, irrespective of the date of patient's admission or discharge. Moreover, the number of procedures, rather than that of individual patients were evaluated. Thus, the number of registered procedures exceeds the real number of patients operated on. Other procedures include adult congenital heart surgeries, heart tumors, surgeries on the thoracic aorta, heart transplants and assist devices implantations. Heart transplants, assist device implantations and surgeries on the thoracic aorta are analyzed in separated tables.

Deaths of patients were defined as in-hospital mortality. Per definition, the observed mortality is always attributed to the first cardiac procedure. Procedures attributable to mortality include not only elective, but also urgent and emergency procedures.

Categorical data are displayed as absolute and/or relative frequencies. Due to the lack of complete data pertaining to patients' risk adjustment, all mortality rates are un-

adjusted. Quantitative data are presented as absolute frequencies. Charts and tables were created with Microsoft Excel for Mac version 16.48 (21041102)

Results

Registry data 2021

Overall, 947 procedures were reported to the registry for the year 2021, which is a difference of -7.2 % as compared to 2020 data (Tab. 1, Fig. 1). Concerning gender distribution, the registry shows an overall male/female ratio of 3.1 : 1 with the greatest difference (4.9 : 1) in the patient group with isolated coronary artery bypass grafting procedures (Tab. 2).

About 4.7 % (n = 44) and 14.8 % (n = 140) of operations were conducted as emergency and urgent procedures, respectively. Also, 13.5 % (n = 128) of the procedures were reoperations (Tab. 3).

The total mortality of all cardiac procedures was 6.4 %. The mortality rates of planned, urgent and emergency procedures were 4.1 %, 8.6 % and 40.9 %, respectively (Tab. 14).

The total number of performed coronary artery bypass grafting procedures (CABG), isolated and combined, was 489. Moreover, 327 CABG procedures (80.5 %) were performed with the use of

Tab. 6. Isolated aortic/mitral valve operations (including MAZE).

Prosthesis/native heart valve	Aortic			Mitral		
	n	†	%	n	†	%
Biological prosthesis	112	5	4.5	11	1	9.1
Mechanical prosthesis	38	1	2.6	15	0	0
Repair	0	0	0	35	0	0
Transapical	24	1	4.2	9	1	11.1
Total	174	7	4	70	2	2.9

Tab. 7. Mitral procedures (including MAZE).

Mitral valve procedures	Repair				Replacement				Total			
	n	†	%	MAZE	n	†	%	MAZE	n	% repairs	†	%
Isolated	36	0	0	13	34	2	5.9	3	70	51.4	2	2.9
+ CABG	16	0	0	1	4	1	25	1	20	80	1	5
+ Tricuspid valve	24	0	0	10	11	1	9.1	9	35	68.6	1	2.9
+ Aortic valve	10	2	20	3	14	0	0	3	24	41.7	2	8.3
+ Aortic + Tricuspid valves	4	0	0	2	6	1	16.7	1	10	40	1	10
+ CABG + Aortic valve	1	1	100	0	4	0	0	1	5	20	1	20
+ other	4	1	25	4	4	1	25	4	8	50	2	25
Total	95	4	4.2	31	77	6	7.8	20	172	55.2	10	5.8

CABG = coronary artery bypass grafting

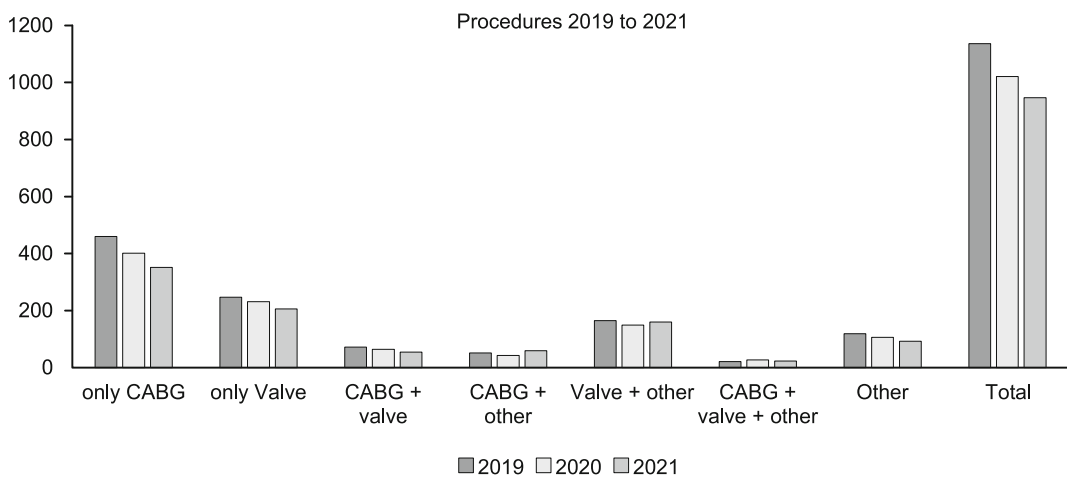


Fig. 1. Frequency of cardiac surgery procedures in 2019, 2020 and 2021.

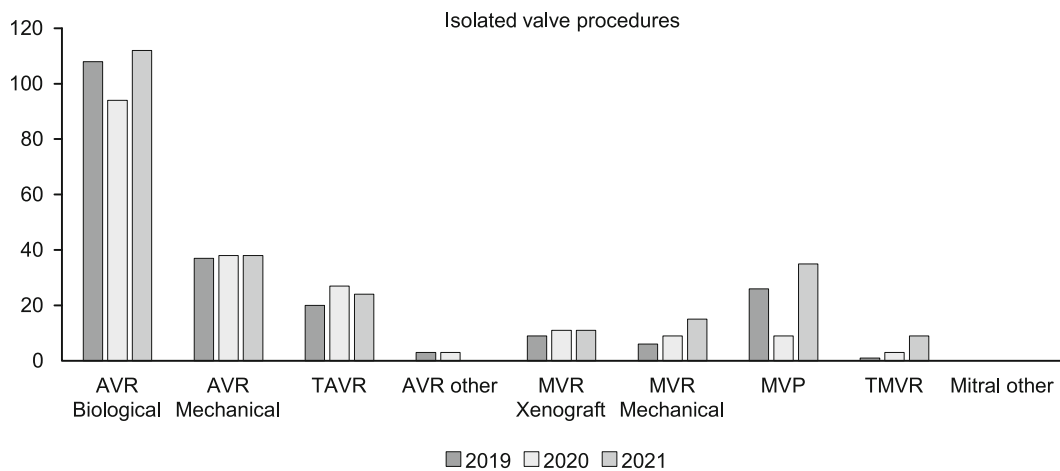


Fig. 2. Frequency of different isolated heart valve procedures in 2019, 2020 and 2021. AVR = aortic valve replacement, TAVR = transcatheter aortic valve replacement, MVR = mitral valve replacement, MVP = mitral valve repair, TMVR = transcatheter mitral valve replacement.

Tab. 8. Transcatheter heart valve procedures.

	Without ECC		With ECC		Total		
	n	†	n	†	n	†	%
TAVR	24	1	0	0	24	1	4.2
TAVR + CABG	1	0	0	0	1	0	0
TAVR +TMVR	1	0	0	0	1	0	0
TMVR	9	1	0	0	9	1	11.1
Total	35	2	0	0	35	2	5.7

TAVR = transcatheter aortic valve replacement, TMVR = transcatheter mitral valve replacement, ECC = extracorporeal circulation

extracorporeal circulation (ECC), and the rest of the procedures (19.4 %) were carried out without it (Tabs 1, 9, 10).

The total number of heart valve procedures, isolated and combined, was 411. Single, double and triple heart valve procedures were performed in 254 (76.7 %), 66 (19.9 %), and 11 (3.3 %) instances, respectively (Tab. 4). In addition, 24 (7.3 %) transcatheter aortic valve replacement (TAVR) and 9 (2.7 %) transcatheter mitral valve replacement (TMVR) procedures were performed (Tab. 8). The main access path for surgery conduction for all the procedures was median sternotomy, while only 4 aortic valve procedures were performed via partial sternotomy (Tab. 5).

In 76 (55.1 %) isolated aortic valve operations using ECC, biological prostheses were implanted, while 95 isolated and combined mitral valve repairs were performed (Tabs 6, 7, Fig. 2).

Regarding the heart transplantation procedures in 2021, there was a decrease in 38.5 % as compared to the 2020 data (Tab. 11). In the year 2021, 20 mechanical ventricular assist devices, 17 HeartMate 3 (Abbot, Plymouth, MN, USA) devices, 1 HeartWare device (Medtronic, Minneapolis, MN, USA) and 2 Syncardia total artificial hearts devices (SynCardia Systems, Tuscon, Arizona, USA) were implanted (Tab. 12).

Moreover, in 2021, 74 aortic surgery procedures were performed of which 6 (8.1 %) and 7 (9.5 %) were carried out with the use of THORAFLEX, and EVITA frozen elephant trunk, respectively (Tab. 13).

As compared to 2020 data, the total number of cardiac procedures in 2021 decreased by 7.2 % as a result of restrictions imposed in consequence of the COVID-19 pandemic. Isolated CABG procedures with a decrease by 12.2 % were followed by the isolated heart valve procedures with a decrease by 10.8 %. In 2021, there was an increase in the number of transcatheter valve procedures (TAVR and (TMVR) whereas the frequency of aortic surgery procedures decreased.

Tab. 9. Isolated CABG with/without ECC (including MAZE).

	With ECC			Without ECC			Total			
	n	†	%	n	†	%	n	MAZE	†	%
Single	36	2	5.6	74	2	2.7	112	6	5	4.5
Double	180	5	2.8	5	0	0	185	15	5	2.7
Triple	102	6	5.9	0	0	0	102	13	6	5.9
Quadruple	9	0	0	0	0	0	9	0	0	0
Quintuple + more	0	0	0	0	0	0	0	0	0	0
Total	327	13	4	79	2	2.5	406	34	15	3.7

ECC = extracorporeal circulation

Tab. 10. Isolated CABG and combined procedures.

Procedure	n	†	%
Isolated CABG	351	13	3.7
CABG + other	58	4	6.9
CABG + AVR	32	1	3.1
CABG + MVP	14	0	0
CABG + MVR	2	0	0
CABG + AVR + MVR	3	0	0
CABG + AVR + MVP	2	1	50
CABG + valve + other	27	3	11.1
Total	489	22	4.5

CABG = coronary artery bypass grafting, AVR = aortic valve replacement, MVP = mitral valve repair, MVR = mitral valve replacement

Tab. 11. Heart transplantation.

Year	n
2020	26
2021	16

Tab. 12. Mechanical assist devices.

Device	2020	2021	Difference %
HeartMate 3	5	17	+340
HeartWare	4	1	-25
Syncardia TAH	2	2	0

TAH = total artificial heart

Tab. 13. Aortic surgery.

Procedure	n	+ thoraflex	†	%
Linear interpositum	27	6	9	33.3
Linear interpositum + mechanical AVR	8	0	0	0
Linear interpositum + biological AVR	10	0	3	30
Yacoub	1	0	0	0
Mechanical Bentall	15	0	1	6.7
Biological Bentall	3	0	2	66.7
EVITA stent graft	7	0	4	57.1
Total	74	6	20	27

AVR = aortic valve replacement

Tab. 14. Urgency.

Procedure	n	†	%
Emergent	44	18	40.9
Urgent	140	12	8.6
Planned	763	31	4.1
Total	947	61	6.4

In 2021, the rate of mitral valve reconstructions increased as compared to 2020.

In 2021, there was a decrease (–61.5 %) in the number of heart transplantations as compared to 2020. On the other hand, mechanical ventricular assist device implantations showed an increase by 72.7 % as compared to 2020.

Discussion

The registry of the National Institute of Cardiovascular Diseases enables a comprehensive overview of all cardiac surgical procedures performed in 2021. The accuracy of the registry is considered to be high, and this is supported also by other authors who could demonstrate a high accuracy for major outcome parameters in unaudited registries (5). Heart surgery performed in Slovakia yields an in-hospital patient survival rate that is comparable to international surveys.

As a result of the COVID-19 pandemic, the number of cardiac surgery procedures carried out in 2021 showed a slight decrease in the frequency of isolated and combined CABG procedures and heart valve procedures, as compared with 2020 data. However, there was a decrease in heart transplantations, and we hope for a more positive trend in the years ahead.

Further improvements in the registry are recommended to enable more specific assessments and particular risk-adjusted data analyses.

Completeness, validity, and further progress depend on continuous efforts and close collaboration of all the interested parties. This will be of outstanding importance in contributing to patient safety and obtaining evidence for the high quality of heart surgery achieved in Slovakia.

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