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ANALYSIS OF CARDIAC CONDUCTION DISORDERS IN ADULT PATIENTS IN THE EARLY POSTOPERATIVE PERIOD AFTER OZAKI SURGERY

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Purpose. To assess the disorders of the cardiac conduction system (CCS) that occurred in the early postoperative period after aortic valve (AV) replacement by the Ozaki method.

Methods. The study included 256 patients after a successfully performed Ozaki procedure. Patients with a history of open cardiac surgery, with an implanted pacemaker, with permanent atrial fibrillation, with simultaneous Ozaki surgery with correction of another pathology, in case of repeated surgery on AV in the next six months, with lethal outcome, under the age of 18 years, when it is impossible to analyze the CCS dynamics were excluded. The mean age was 57.9±11.1 years, the male sex was 119 people (46.5%), the body mass index was 29.7±5.5 kg/m^2, diabetes was observed in 40 patients (15.6%), anamnesis of CCS disorders in 10 (3.9%), CCS disorders on the baseline electrocardiogram (ECG) in 32 (12.5%). Conduction abnormalities were assessed according to the anamnesis and the results of daily ECG recording.

Results. In the early postoperative period, CCS disorders were registered in 35 patients (13.7%), of whom 27 (10.6%) had their first occurrence, and 8 (3.1%) had previously existed. By the time of discharge, persistent CCS disorders (which occurred for the first time and in the case of progression of pre-existing blocks) remained in 11 (4.3%): 8 (3.1%) had bundle branch blocks, 3 (1.2%) had atrioventricular blocks that required implantation of a permanent pacemaker. Patients with pacemaker had initial conduction abnormalities. The most frequent dysfunction of the CCS was the left bundle branch block (LBBB) (45.5%). We analyzed 14 variables as predictors of the onset or progression of persistent CCS disorders. Two independent predictors were identified - the presence of conduction abnormalities on the baseline ECG and the time of cardiopulmonary bypass. In patients with persistent conduction disturbances in the postoperative period, CCS disorders on the baseline ECG were more common - 36.4% compared with patients without CCS disorders after surgery - 11.4% (p=0.035) and there was a longer duration of cardiopulmonary bypass 140.6±41.1 min. and 122.4±26.1 min. respectively (p=0.03).

Conclusion. The most frequent disorder of the conduction was the LBBB. None of the first dysfunctions of CCS led to the implantation of the pacemaker. The presence of initial ECG conduction disturbances and the time of cardiopulmonary bypass were independent predictors of the occurrence or progression of persistent CCS disorders.

Key words: aortic valve; operation Ozaki; cardiac conduction system disorders; atrioventricular block; time of cardiopulmonary bypass

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Aortic stenosis (AS) is one of the most common valvular heart diseases in adults. Isolated AS occurs in 1.5-2% of cases of acquired valvular heart disease, but in combination with some degree of aortic regurgitation it is much more common, occurring in up to 23%. Surgical aortic valve (AV) replacement and transcatheter aortic valve implantation (TAVI) are the most recognized surgical treatments for aortic valve defects [1, 2]. Correction of aortic disease using Ozaki autopericardium method has become more common in the last decade. This method has been shown to be excellent in patients with narrow aortic ring in whom lifelong anticoagulant therapy is contraindicated, preserving the contribution of the aortic root to cardiac function and significantly improving hemodynamics [3-5]. Cardiac conduction system (CCS) dysfunction occurring in the early postoperative period may worsen the postoperative period and outcome of any surgical treatment option for aortic valve disease. The development of atrioventricular (AVB) and intraventricular blocks are considered the most common CCS disorders following aortic root surgery. Left bundle branch block (LBBB) and the need for permanent right ventricular pacing contribute to left ventricular dyssynchrony and increase the risk of

heart failure and mortality (randomized clinical trials MOST, MADIT II, DAVID). LBBB after TAVI occurs in 5-65% of cases, AVB requiring pacemaker implantation in 9-49%, depending on valve design, averaging 20.8%. After aortic valve replacement, CCS abnormalities occur in 4.5% and 1.5-6.9% of cases, respectively [6-10]. In most studies of aortic valve repair using Ozaki method, there is little evidence of postoperative CCS abnormalities, so the extent to which these complications are characteristic of these patients is not known. Therefore, the aim of our study was to investigate abnormalities of CCS in the early postoperative period after Ozaki aortic valve replacement.

MATERIAL AND METHODS

Ozaki surgery has been performed at the Penza Federal Center for Cardiovascular Surgery since 2015. From January 2017 to December 2020 607 isolated Ozaki AV replacements were performed, as well as Ozaki AV replacement combined with correction of other cardiac and extracardiac pathologies. We selected patients from this cohort after isolated Ozaki procedure and Ozaki AV replacement with ascending aorta and retrospectively analysed them.

We excluded single-stage combined procedures to minimise their impact on intracardiac management. The method of autopericardial correction of AV defects using Ozaki method has been described previously [11]. The indications for surgery were determined in the consultation with the specialists of the cardiac center after the examination, which, in addition to the routine clinical and laboratory methods, included the obligatory registration of the electrocardiogram (ECG) in 12 leads, echocardiography, coronary angiography, duplex ultrasound examination of brachiocephalic and lower limb arteries, Holter monitoring and contrast-enhanced computed tomography of the heart (as indicated).

Inclusion criteria: successfully performed isolated AV repair by Ozaki method and AV repair by Ozaki method with prosthesis of the ascending aorta.

Exclusion criteria:

- history of previous open heart surgery;
- one-stage Ozaki AV surgery with/without prosthetic ascending aorta with correction of other cardiac or extracardiac pathology;
- re-correction of the aortic defect within the next 6 months;
- death;
- age <18 years;
- previously implanted pacemaker;
- chronic form of atrial fibrillation;
- inability to analyse the dynamics of CCS for any reason.

A total of 256 patients were included in the study. Conduction abnormalities were assessed by history and results of daily pre- and postoperative ECG and Holter monitoring (if indicated). The characteristics of the patients included in the study are listed in Table 1.

There were 10 patients with conduction abnormalities in the history: one patient had LBBB, two - right bundle branch block (RBBB), two - 1st degree AVB, five - 2nd and 3rd degree AVB. Two out of five patients with 2nd and 3rd degree AVB 2:1 had preoperative indications for planned pacemaker implantation, they were implanted with pacemaker in DDDR mode after Ozaki surgery in the second stage. The other three patients had no confirmed AVB during this hospital stay, indications for pacemaker implantation were not confirmed, and they continued to be dynamically monitored. Thirty-two patients were found to have CCS abnormalities on admission according to ECG, Holter monitoring (if available). The types of initial conduction abnormalities are listed in Table 2.

Statistical evaluation

All clinical data of the patients were taken from an electronic medical record system ("Medialog" 7.10 B0119). Statistical processing of the results was done with IBM® SPSS® StatisticsVersion 21 (21.0.0.0). All quantitative variables were checked for their distribution type using the Kolmogorov-Smirnov criterion, graphically using quartile plots and asymmetry and kurtosis indices. If the distribution was symmetrical, the results were given as arithmetic mean and standard deviation (M±SD). If the distribution was not symmetrical, values were represented by the median (Me) and the interquartile range as the difference between the third and first quartile. Qualitative data were described with frequencies (n) and proportions (percentages). Risks were assessed using stepwise multivariate logistic regression analysis. The latter was used to adjust the independent predictors included in the statistical model that influence the dependent variable (persistent

Table 1.

Clinical and demographic characteristics of patients included in the study (n=256)

Parameter	Value
Age, years	57.9±11,1
Male sex, n (%)	119 (46.5)
Body mass index, kg/m^2	29.7±5.5
Diabetes mellitus, n (%)	40 (15.6)
Diagnosis, n (%)	
Degenerative disease	161 (62.9)
Congenital aortic valve defect	60 (23.4)
Chronic rheumatic heart disease	29 (11.4)
Endocarditis	6 (2.3)
Type of malformation, n (%)	
Stenosis	198 (77.3)
Insufficiency	30 (11.7)
Stenosis and insufficiency (no prevalence)	28 (11.0)
Aortic valve morphology, n (%)	
Three leaves	169 (66,0)
Other number	87 (34.0)
Secondary endocarditis, n (%)	5 (2.0)
History of conduction abnormalities, n (%)	10 (3.9)
ECG conduction abnormalities at baseline, n (%)	32 (12.5)

Note: Hereinafter ECG means electrocardiogram.

conduction disorders in the postoperative period). The data are represented by the significance level reached (p) and the 95% confidence interval (95% CI). The critical significance level is assumed to be < 0.05.

RESULTS

In the early postoperative period, conduction abnormalities were found in 35 patients (13.7%), in 27 of them (10.6%) they occurred postoperatively for the first time (ECG on admission without CCS abnormalities), and in 8 (3.1%) they existed previously. Among the first time ("acute") CCS disorders, 21 patients had LBBB, 2 - RBBB, 2 – LBBB of the anterior branch (AB), 2 - 1st degree AVB. It is interesting to note that of the 27 cases of "acute" conduction disturbances, in 4 cases (LBBB) the pathology persisted until discharge and none of the CCS disturbances that occurred first led to progression with subsequent pacemaker implantation. In contrast, 3 of 8 patients with pre-existing conduction abnormalities developed AVB requiring pacemaker implantation during the same hospital stay (day 2, 6 and 13). Two of 8 patients had transient deterioration of atrioventricular excitation conduction that did not require permanent pacing. The patients with pacemaker had initial excitation conduction abnormalities in ECG: in the first case - LBBB, in the second - 1st degree AVB + RBBB + AB of LBBB, in the third - LBBB. Complete AVB in the first case, 2nd degree AVB in the second and third cases were indications for pacemaker implantation. By the time of discharge, persistent CCS abnormalities, both first occurring in patients with initially unchanged ECG and progression of pre-existing conduction blocks, persisted in 11 (4.3%): in 8 (3.1%) stem blocks, in 3 (1.2%) - AVB, which required permanent pacemaker implantation. The perioperative parameters are listed in Table 3.

Table 2.

Cardiac conduction abnormalities on resting electrocardiogram at admission (n=32)

Type of conduct violation	Value
LBBB, n (%)	8 (25.0)
Transient LBBB, n (%)	3 (9.4)
Persistent LBBB, n (%)	5 (15.6)
RBBB, n (%)	5 (15.6)
RBBB+AB LBBB, n (%)	1 (3.1)
AVB 1st degree*, n (%)	11 (34.4)
AVB 1st degree + RBBB, n (%)	2 (6.25)
AVB 1st degree + RBBB + AB LBBB, n (%)	2 (6.25)
AB LBBB, n (%)	3 (9.4%)

Note: hereinafter, LBBB, left bundle branch block; RBBB, right bundle branch block; AB LBBB, anterior branch of left bundle branch block; AVB, atrioventricular block; *, total.

It should be noted that the follow-up examination by an arrhythmologist, ECG registration and pacemaker interrogation revealed 3d degree AVB and dependence on pacemaker (VP 100%) only in the first case, in the second case AVB resolved to the 1st degree, in the third case there were episodes of worsening atrioventricular conduction (VP 47.4%) compared to initial LBBB. Follow-up was performed at different time points (day 1, day 3 and 13 months later, respectively). Data were collected from 5 patients with persistent postoperative AV conduction abnormalities between 8 and 13 months after surgery. In 3 cases, the conduction blocks resolved (LBBB, RBBB, AB of LBBB); in two cases, the LBBB remained without progression.

Depending on the presence or absence of first-time persistent conduction abnormalities on the ECG on the day of hospital discharge, patients were divided into two groups to assess the possible predictors of conduction abnormalities in the postoperative period. The data are presented in Table 4. The patient groups did not differ according to age, sex, body mass index, history of CCS, diabetes mellitus, secondary endocarditis, etiology and type of aortic defect, number of AV cusps, type of surgery, euroSCORE II, time of myocardial ischemia. Patients with persistent conduction abnormalities in the postoperative period had more frequent abnormalities of CCS on initial ECG - 36.4% compared to patients without persistent postoperative CCS - 11.4% (p=0.035) and longer duration of artificial circulation 140.6±41.1 min and 122.4±26.1 min respectively (p=0.030).

Table 3.

Perioperative characteristics of patients (n=256)

Perioperative parameters	Value
euroSCORE II, %	1.6 [1.1-3.0]
Ozaki procedure, n (%)	187 (73.0)
Ozaki procedure+Aorta, n (%)	69 (27.0)
Time of artificial circulation, min	123.2±27.1
Myocardial ischemia time, min	98.9±21.5
Transient conduction abnormalities after surgery, n (%)	35 (13.7)
Persistent conduction abnormalities after surgery, n (%)	11 (4.3)
Intraventricular conduction disorders, n (%)	8 (3.1)
LBBB, n (%)	5 (1.9)
AB LBBB, n (%):	1 (0.4)
RBBB, n (%)	1 (0.4)
RBBB + AB LBBB, n (%)	1 (0.4)
AVB*, n (%)	3 (1.2)
AVB 3d degree, n (%)	1 (0.4)
AVB 2nd degree 2:1, n (%)	1 (0.4)
AVB 2nd degree + LBBB, n (%)	1 (0.4)

Note: euroSCORE (European Systematic COronary Risk Evaluation) II - cardiac surgical mortality risk assessment scale (updated version).

We analysed 14 variables as predictors of the initial occurrence of persistent CCS and progression of existing conduction abnormalities in the postoperative period: age, sex, body mass index, history of CCS, conduction abnormalities in baseline ECG, diabetes mellitus, secondary endocarditis, etiology of AV disease, type of AV defect, number of valve

leaflets, type of surgery, euroSCORE II, time of myocardial ischemia, time of artificial circulation. Two independent predictors of progression of pre-existing and persistent abnormalities of the CCS after Ozaki surgery were found - the presence of conduction abnormalities in the baseline ECG and the time of artificial circulation. In addition, the presence of ECG blocks before surgery increases the risk of progression of excitation conduction abnormalities almost 7-fold. The data are shown in Table 5.

DISCUSSION

The development of CCS is a common complication of AV interventions. These include persistent and transient bundle branch blocks, AVBs [6-10, 12]. According to previously published data, persistent complete AVB develops in 3-6.9% of cases after AV replacemaent [6-10]. According to the recent SURTAVI study (n=1746), the need for pacemaker after AV replacement was 6.6% and after TAVI with a self-expanding valve 25.9% [9]. The PARTNER study (n=2032) showed that AVB led to pacemaker implantation in 6.9% of cases after AV replacement and in 8.5% of cases after TAVI with a balloon-expandable valve [10]. According to some authors, first-time LBBB occurs after TAVI in 5-85% of patients and after AV replacement in 4.6-5.7% of patients. In patients with pre-existing RBBB, the development of LBBB has a prognostically unfavourable value and inevitably leads to complete AVB [8, 12, 13].

In contrast to the CCS abnormalities after AV replacement and TAVI, which have been investigated in large studies, the analysis of excitation conduction abnormalities after Ozaki surgery has not yet been performed. At best, there are a few references to permanent pacemaker implantation in publications without analysis of the prior and postoperative rhythm abnormalities that served as indications for implantation. According to a small study of 30 patients after an isolated Ozaki procedure (n=17), pacemaker implantation was not required; 3 patients (10%) were implanted after simultaneous Ozaki surgery and mitral valve and septal intervention [3].

In a multicentre study of 170 patients (94 (55%) underwent the isolated Ozaki procedure and 76 (45%) the combined procedure), pacemaker implantation was performed in 2 (1.2%) patients [14]. In a retrospective observational study involving 142 patients, AV reconstruction was compared with Ozaki technique after J-ministernotomy and conventional sternotomy. Only 1 (3%) patient in the group required pacemaker implantation; there were no implantations in the total conventional group (p=1.0) [15]. Several other studies initiated by Ozaki (n=404, n=108) [11, 16], literature reviews [6, 17] mentioned no conduction abnormalities in conjunction with Ozaki procedure. In a national multicentre study published in 2020 that examined the immediate outcomes of Ozaki surgery, arrhythmias requiring pacemaker implantation in the postoperative period were considered one of the secondary endpoints. A total of 724 patients who underwent surgery between 2015 and 2019 were included in the registry. Isolated intervention was performed in 314 (43.4%) patients and combined intervention in 410 (56.6%) patients. Cardiac access was by midline sternotomy in 687 (95%) patients and by ministerotomy in 37 (5%). Pacemaker implantation was required in 13 patients (1.8%) [4]. Unfortunately, the registry lacks data on the type of arrhythmias for which a pacemaker was implanted. It is known that in addition to AVB, sinus node weakness or chronic brady form of atrial fibrillation may be indications [12]. Furthermore, patients may have preoperative indications for pacemaker implantation.

Table 4.

Characteristics of patients according to the presence or absence of persistent abnormalities of the cardiac conduction system after surgery

Indicator	Persistent CCS impairment after surgery		p
	No (n=245)	Yes (n=11)	
Age, years	57.8±11.3	61.3±7.0	0.314
Male sex, n (%)	113 (46.1%)	6 (54.5%)	0.404
Body mass index, kg/m^2	29.7±5.5	28.4±4.5	0.443
Diabetes mellitus, n (%)	39 (15.9%)	1 (9.1%)	0.464
Diagnosis, n (%)			
Degenerative malformation	153 (62.5%)	8 (72.7%)	0.611
Congenital aortic valve disease	57 (23.3%)	3 (27.3%)	
Chronic rheumatic heart disease	29 (11.8%)	0 (0%)	
Endocarditis	6 (2.4%)	0 (0%)	
Type of defect, n (%)			
Stenosis	187 (76.3%)	11 (100%)	0.186
Insufficiency	30 (12.3%)	0 (0%)	
Stenosis and insufficiency (no prevalence)	28 (11.4%)	0 (0%)	
Aortic valve morphology, n (%)			
Three leaves	169 (66.0%)	7 (63.6%)	0.468
Other number	87 (34.0%)	4 (36.4%)	
Secondary endocarditis, n (%)	5 (2.0%)	0 (0%)	0.801
History of conduction abnormalities, n (%)	9 (3.7%)	1 (9.1%)	0.361
Conduction abnormalities at baseline, n (%)	28 (11.4%)	4 (36.4%)	0.035
EuroSCORE II, Me[Q25-Q75]	1.6 [1.1-3.0]	1.7 [1.4-3.2]	0.413
Ozaki procedure, n (%)	181 (73.9%)	6 (54.5%)	0.144
Ozaki procedure+Aorta, n (%)	64 (26.1%)	5 (45.5%)	
Time of artificial circulation, min	122.4±26.1	140.6±41.1	0.030
Myocardial ischemia time, min	98.5±20.9	109.0±32.3	0.114

Note: CCS is the cardiac conduction system

In addition to demonstrating that there is less need for permanent pacemaker implantation after Ozaki procedure, the literature review shows the lack of data on postoperative CCS abnormalities. According to our study, 5 (1.9%) patients had persistent LBBB on ECG on the day of discharge. According to studies, patients with LBBB develop left ventricular dyssynchrony and heart failure as well as permanent right ventricular pacing [18, 19].

The first occurrence of LBBB in patients after TAVI was associated with an increased need for an electrocardiogram and no improvement in left ventricular ejection fraction at one year, as well as an increased risk of all-cause mortality [12]. The first occurrence of LBBB after AV replacement was associated with worsening functional status and an increase in heart failure, with no significant effect on mortality [20]. It is unclear whether it is correct to extrapolate data from patients after TAVI and AV replacement to Ozaki population. At the very least, the low incidence of intraventricular block in our patients has undeniable advantages. According to the results of our work, the need for a permanent pacemaker occurred in 3 (1.2%) patients. Large clinical trials (MOST, MADIT II, DAVID) have demonstrated a correlation between the burden of right ventricular stimulation and the development of heart failure, and mortality.

Selective stimulation of the His or LBB or may be electrically and hemodynamically preferable for patients with persistent atrioventricular abnormalities after Ozaki procedure. LBB pacing, by reducing interventricular dyssynchrony, prevents the progression of heart failure and the occurrence of atrial fibrillation and can be considered a potential alternative to apical right ventricular pacing [21]. The low need for pacemaker implantation after Ozaki surgery is an additional advantage of this method for the treatment of AV disease. To assess the long-term effects of right ventricular pacing on the risk of heart failure and mortality after Ozaki surgery, further studies are needed.

The risks of conduction abnormalities are determined by the anatomical proximity of CCS to the aortic root. The atrioventricular node is located in the interatrial septum, slightly distal to the aortic root. Then the His bundle goes to the central fibrous body, which is located at the level of the triangle formed by the right coronary and non-coronary sinuses with the adjacent membranous part of interventricular septum.

At the level of the central fibrous body, the His bundle penetrates the membranous part and extends to the anterior surface of the crest of the muscular part of the interventricular septum. At this level, the His bundle divides into a left peduncle that extends along the left ventricular wall and a right peduncle that penetrates the muscular septum and exits medially on the surface of the papillary muscles. Anatomical differences in the length of the infiltrating part of the His bundle, in the level of septal penetration and variations in the location of the proximal part of the left bundle have been associated with the susceptibility of the CCS to surgical trauma during AV surgery [12, 22]. Based on autopsy material from 115 elderly patients, three anatomical variations were described for the location of the atrioventricular junction: right-sided (50%), left-sided (30%) and under the diaphragmatic septum (20%).

In the latter two variants, atrioventricular conductance abnormalities occur more frequently. The development of LBBB is influenced not only by the level of penetration, but also by the individual features of close localization of the membranous portion of the interventricular septum to the AV cusps [23].

At AV replacement, conduction abnormalities are directly related to surgical tactics: suturing, removal of native AV, especially in combination with dilated decalcification, compression of the CCS when large valves are used, development of oedema and/or hematoma of para-aortic tissue. In addition, significant coronary lesions impede adequate cardioprotection during cardiac arrest and lead to ischemia and possible conduction blocks [6, 22]. In the case of TAVI, the development of CCS disturbances is associated less with the operator than with the valve design and the procedure itself. Permanent radial compression of the aortic root, forcing calcified tissue and a metal stent under high pressure into the delicate CCS structures, can lead to transient or persistent conduction disturbances [6, 12, 23].

For the AV replacement according to Ozaki method, native pericardium pre-treated with glutaraldehyde solution is used, from which the flaps are cut according to the dimensions of the original Ozaki template. The cusps are implanted in the projection of the previously dissected valve, starting with the right coronary cusp, then the left and non-coronary cusps. For flail implantation, we use a continuous convoluted suture with Premilene 4/0. Commissure formation is performed with separate P-sutures on felt pads using Premilene 4/0 sutures [15]. Such a surgical design prevents mechanical compression of the AV prosthesis in the projection of the conduction system. And the use of less traumatic sutures without the need for "deep" fixation of the flaps to the fibrous ring minimizes the risk of damage to the conduction system. Therefore, we believe that the development of transient CCS disorders with the occurrence of traumatic oedema/hematoma and persistent disorders is associated with the individual anatomical proximity of the aortic root complex to the atrioventricular node and its distal conduction fibres, as well as extensive decalcification of the aortic root.

In our study, pre-existing CCS abnormalities were predictors of the development of new persistent or progressive blocks in the postoperative period. This is not only typical for Ozaki surgery, but also for AV replacement and TAVI. History of LBBB, RBBB and staged AVB were predictors of pacemaker implantation in the early postoperative period after VAR and TAVI [7, 9, 12, 13, 20, 24, 25]. LBBB is the most common impairment of intraventricular conduction after AV surgery, with existing LBBB almost certainly leading to distal-type AVB.

Table 5.

Assessment of risk factors for persistent cardiac conduction system abnormalities in the early postoperative period (n = 256)

Indicator	OR	95%CI	P
ECG conduction abnormalities at baseline	6.813	1.168-39.724	0.030
Cardiopulmonary bypass time	1.080	1.015-1.148	0.014

Note: OR, odds ratio; 95% CI, 95% confidence interval.

Two of the three patients with implanted pacemaker from our study had initial LBBB, one had LBBB with slow progression of atrioventricular conduction abnormality to staged block, with delayed pacemaker implantation on day 13. Duration of cardiopulmonary bypass was another predictor of persistent postoperative CCS in our study. Longer duration of cardiopulmonary bypass is often associated with more severe AV degeneration requiring intensive decalcification associated with CCS trauma. Similar findings have been reported in a number of studies in AV replacement and TAVI: severe calcinosis and prolonged cardiopulmonary bypass time were predictors of persistent AVB requiring pacemaker implantation [6, 12, 26, 27].

In at least 3 of 8 patients discharged after surgery with a first-time intraventricular block, no abnormalities were noted on ECG follow-up. Of the three cases where an ECG was implanted at follow-up, one patient continued to have an absolute need for an ECG; therefore, the question remains: how persistent are CCS abnormalities really? Given the small sample of patients, we do not yet have an answer to this question. A number of studies have shown restoration of atrioventricular conduction and resolution of intraventricular block after AV replacement and TAVI. In 30-50% of patients with LBBB after TAVI, CCS disturbances were no longer recorded after one month [12], and only 44% of patients remained pacemaker-dependent after 1-40 months of follow-up [7]. Of 10 patients after AV replacement with implanted pacemaker for the complete AVB, 4 patients had no need for right ventricular pacing (follow-up 36-48 months) [6]. Permanent pacing should be considered at 10 days postoperatively at the earliest. The increased threshold for epicardial electrode stimulation and the caregiver's fear for the patient's life sometimes lead to a hasty decision.

In addition, interesting facts about preoperative abnormalities of the CCS were found by M. Urena et al. (2015). All patients with severe AS underwent a Holter monitoring one day before the planned TAVI surgery. Significant arrhythmias were found in 16.1% of patients, including high-grade AVB [12]. This confirms the previous findings of an electrophysiological study on the association of AS with abnormal CCS: prolongation of the intervals PR, AH and HV and a higher degree of AVB [13]. It is likely that what we consider first-time CCS abnormalities in the postoperative period are in fact not new at all. In our study, preoperative Holter monitoring was not routinely performed.

CONCLUSION

Persistent conduction abnormalities in the early postoperative period after Ozaki operation were detected in 11 (4.3%) patients. The most frequent ones were LBBB (45.5%) and 2nd and 3d degree AVB (27.3%). The need for a permanent pacemaker was 1.2%.

The presence of baseline conduction abnormalities on ECG and time of artificial circulation were the dependent predictors of the occurrence or progression of persistent conduction abnormalities of the cardiac conduction system. The presence of baseline conduction abnormalities on baseline ECG increased the risk of progression of conduction abnormalities almost 7-fold.

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