International Journal of Cardiology 294 (2019) 23–26

Contents lists available at ScienceDirect

International Journal of Cardiology

journal homepage: www.elsevier.com/locate/ijcard

Dental screening prior to valve interventions: Should we prepare transcatheter aortic valve replacement candidates for "surgery"?

Shemy Carasso [a,b,*], Dalit Porat Ben Amy [b,c], Fabio Kusniec [a,b], Diab Ghanim [a,b], Doron Sudarsky [a,b], Wadi Kinany [a,b], Chen Shmuel [b,c], Imad Abu El-Naaj [b,d], Erez Kachel [a,b], Offer Amir [a,b]

[a] Division of Cardiovascular Medicine, B Padeh Medical Center, Poriya, Lower Galilee 15208, Israel
[b] The Azrieli Faculty of Medicine in the Galilee, Bar-Ilan University, Safed 1311502, Israel
[c] Oral Medicine Unit, B Padeh Medical Center, Poriya, Lower Galilee 15208, Israel
[d] Oral and Cranio-maxillofacial surgery Department, B Padeh Medical Center, Poriya, Lower Galilee 15208, Israel

ARTICLE INFO

Article history:
Received 2 March 2019
Received in revised form 1 June 2019
Accepted 25 July 2019
Available online 26 July 2019

ABSTRACT

Background: 40% of cases of infective endocarditis (IE) are likely caused by oral bacteria. IE prevalence after transcatheter aortic valve replacement (TAVR) is comparable to IE following surgical prosthetic valve replacement (SVR). Current guidelines recommend pre-operative dental screening for SVR, without specific recommendations regarding TAVR.

We aimed to compare oral dental findings in TAVR vs. surgical valve replacement (SVR) candidates and assess the need for routine dental screening and treatment prior to TAVR similar to the SVR patients.

Methods: 150 patients (58 TAVR candidates and 92 surgical candidates) were all referred for screening and appropriate treatment before intervention to our Oral medicine team, blinded to the planned interventional type. All patients were scored for oral hygiene and dental findings that required intervention. An oral health score (OHS, general hygiene: 0-good, 1-bad, need for immediate treatment: 0-no, 1-yes, need for future treatment: 0-no, 1-yes) was calculated and compared. Patients were clinically followed for IE for 14 ± 5 months (rage 8–28) post intervention.

Results: While candidates for SVR were younger than TAVR (66 + 10 vs. 81 ± 6 respectively, $P < 0.0001$), oral-dental findings were similar. OHS was 1.6 for SVR and 1.7 for TAVR candidates, $p = 0.45$). Half of patients in either group had findings requiring pre-procedural dental treatment. There were two IE cases during follow-up, one in each group.

Conclusion: Oral health and need for pre-procedural dental treatment were not different among candidates for SVR and TAVR. IE preventive oral-dental care seems to be justified in patients undergoing TAVR initially denied SVR due to prohibitive operative risk.

1. Introduction

Infective endocarditis (IE) following surgical valve replacement has been reported to occurs in 1% to 6% of patients and is associated with high morbidity and mortality [1,2]. *trans*-Catheter aortic valve replacement (TAVR) has emerged as a therapeutic option for patients with symptomatic severe aortic stenosis considered at intermediate, high or prohibitive surgical risk [2]. Data on IE after TAVR have been limited to case reports and relatively small series with limited follow-up. The rate of IE within the year following TAVR has been reported to be 3.5%, ranging from 0.5% to 5% [3–5] similar to IE rates after surgical valve replacement. A recent change in the recommendations for prophylactic antibiotics added TAVR as an indication for post implantation IE prophylaxis [3]. However, the outcome of post TAVR IE has been grim demonstrating in-hospital complication and mortality rates as high as 87% and 47%, respectively.

Bacteremia has been shown to frequently occurs after dental procedures [6], with cumulative incidence of approximately 60%. Post dental procedure bacteremia may last up to 60 min after the procedure [7–9]. While the cause and effect between dental infection and IE has never been scientifically demonstrated, an association has been shown is very likely to exist. Accordingly current AHA/ACC guidelines recommend only surgical valve replacement candidates to have a dental screening prior to their operation for IE prevention [1,2]. The European society of cardiology recommends that potential sources of dental sepsis should be eliminated at least 2 weeks before implantation of a prosthetic valve or other intracardiac or intravascular foreign material without specifying the route by which they may have been implanted [3]. This statement was based on the French society of oral

* Corresponding author at: The Faculty of Medicine in the Galilee, Bar-Ilan University, 8 Henrietta Szold Street, POB 1589, Safed 1311502, Israel.
E-mail address: scarasso@poria.health.gov.il (S. Carasso).

https://doi.org/10.1016/j.ijcard.2019.07.081
0167-5273/

surgery recommendations from 2006 regarding SVR only [10]. In a systematic review of literature regarding Pre-procedural dental screening for cardiovascular invasive procedures no satisfactory answers regarding dental care before cardiovascular invasive procedures could be provided [11]. At this time no specific recommendations exist regarding dental screening for TAVR candidates.

We aimed to compare oral dental screening findings in TAVR vs. surgical valve replacement (SVR) candidates and based on these findings to further assess the need for routine dental screening and treatment prior to TAVR similarly to patients undergoing SVR.

2. Methods

2.1. Study population

In October 2016 we extended our institutional surgical valve replacement pre-procedural preparation protocol to include TAVR candidates. A significant part of the protocol included oral-dental examination/treatment prior to surgery. Thus, between October 2016 and October 2017 all candidates for valve replacement (150 patients, age 70 ± 11, 50% male gender) were prospectively referred to our Oral medicine unit for evaluation and treatment if needed. The oral medicine team was blinded to the type of planned interventional treatment (TAVR vs. SVR). The median time between oral examination (and treatment, if required) and TAVR or SVR was 5 days (95% CI for the median: 4-7 days).

2.2. Oral-dental screening and treatment

Patients underwent clinical and radiological examinations by a dentist from the oral medicine unit, experienced in treating medically compromised patients. All patients had a panoramic radiograph and peri-apical images as needed and a thorough dental, periodontal and mucosal examination. Finding of acute infection (dental or periodontal abscess, root remnants, gingivitis due to massive dental plaque and calculus accumulation) was noted and appropriate treatment was delivered (extraction, scaling and/or root planning). If a fungal infection was suspected, a fungal culture was taken and if indicated – anti-fungal treatment was administered. An oral health score (OHS) was applied based on general hygiene and the necessity of/for dental treatment, either immediate or later after the heart procedure. The OHS was calculated as the sum of the following indices: general hygiene index, 0-good, 1-bad, need for immediate treatment, 0-no, 1-yes, need for future treatment, 0-no, 1-yes. Each index as well as the total OHS were calculated and compared. Patients were clinically followed for IE for 14 ± 5 months (rage 8–28) post intervention.

2.3. Statistical analysis

Continuous variables are presented as mean (SD). Comparison between groups was performed using the *t*-test for continuous variables and χ^2 test for categorical variables. Statistical significance was set at $p < 0.05$. Statistical analyses were done using MedCalc Statistical Software version 18.11.6 (MedCalc Software bvba, Ostend, Belgium; https://www.medcalc.org; 2019).

2.4. Ethics

This study was approved by the institutional ethics board as part of the cardiovascular division clinical and interventional registry.

3. Results

3.1. Patients' clinical characteristics

During the observation period 150 patients (58 TAVR and 92 SVR) were evaluated pre-operatively for valve replacement, referred for routine dental screening/treatment as appropriate.

Candidates for TAVR were octogenarians and nearly two decades older than surgical valve replacement candidates (Table 1). Representing their higher surgical risk profile most were hypertensive (twice the prevalence compared to SVR), they had worse renal function, twice the rate of previous percutaneous coronary interventions and ten times the rate of previous coronary artery bypass graft surgery. History of prior myocardial infarction and pre-operative ejection fraction were similar. Interestingly candidates for TAVR were in worse functional capacity compared to candidates for surgical valve replacement by their NYHA functional class (Table 1). Candidates for TAVR were inherently patients with severe aortic stenosis without aortic insufficiency (Table 2), with a similar aortic valve area compared to SVR candidates. They were more likely than SVR candidate to have ≥moderate mitral regurgitation.

3.2. Dental findings

Generally, the two groups were similar regarding their oral findings (Fig. 1). About two thirds had teeth (65% vs. 73%, for TAVR vs. SVR candidates, respectively, $p = 0.34$). Only a quarter of patients in either group were considered by the oral medicine team to have "good" oral hygiene, i.e. – no gingivitis or periodontitis, without need for periodontal intervention (scaling and root planning). Half of patients in either group were found to have poor prognosis teeth (deep caries of non- restorable teeth, root remnants or active (purulent) or extensive periapical abscess) and required dental treatment prior to planned intervention (45% vs. 55%, for TAVR vs. SVR candidates, respectively, $p = 0.2$). Patients with carious teeth without the above characteristics did not require immediate pre-operative treatment and future restorative treatment was recommended. A simple oral health score (OHS) was devised integrating the oral examination findings (general hygiene, need for immediate treatment and need for future treatment). The OHS was found to be 1.6 ± 1.1 for TAVR and 1.7 ± 1.2 for SVR candidates, $p = 0.45$).

3.3. Infectious endocarditis

Patients were routinely followed at our valve clinic at 1, 3, 6 months post procedure and yearly thereafter. During 15 ± 4 months (8–28, median 14.5 months) of follow-up until June 2018 there were two cases of late IE, one in each of the groups. Both patients had pre-operative dental treatment.

Table 1
patient characteristics
TAVR denotes Transcatheter Aortic valve replacement, SVR – surgical valve replacement.

		TAVR candidates $n = 58$	SVR candidates $n = 92$	*p*-Value
Age (years)		81±6	66±10	<0.0001
Gender	Male	25 (43)	50 (54.3)	NS
	Female	33 (57)	42 (45.7)	
Diabetes mellitus		29 (50)	37 (40)	NS
Hypertension		52 (89.6)	54 (58.6)	0.0005
Prior Stroke		3 (5.1)	6 (6.5)	NS
Peripheral arterial disease		5 (8.6)	4 (4.3)	NS
Prior coronary bypass graft		6 (10.3)	1 (1)	0.008
Prior percutaneous coronary intervention		43 (74.1)	38 (41.3)	0.008
History of myocardial infarction		10 (17.2)	13 (14.1)	NS
Functional class				
NYHA (n,%)	CLASS 1	6 (10.3)	19 (20.6)	NS
	CLASS 2	5 (8.6)	36 (39.1)	<0.0005
	CLASS 3	36 (62)	36 (39.1)	0.0005
	CLASS 4	4 (6.8)	1 (1.08)	<0.0005
Left ventricular function				
Left ventricular Ejection fraction >40%		51 (87.9)	76(82.6)	NS
Renal function				
Glomerular filtration rate (ml/min)	>50	36 (62)	89 (96.7)	<0.05
	30–50	12 (20.6)	1 (1.08)	<0.0005
	<30	10 (17.2)	2 (2.2)	0.0009

Table 2
Echocardiographic finding prior to valve intervention
TAVR denotes Transcatheter Aortic valve replacement, SVR – surgical valve replacement.

	TAVR candidates n = 58	SVR candidates n = 92	p-Value
Left ventricular ejection fraction (%)	58 ± 12	57 ± 13	NS
Aortic valve area (cm^2)	0.8 ± 0.2	0.8 ± 0.2	NS
Aortic valve area index (cm^2/m^2)	0.43 ± 0.08	0.45 ± 0.10	NS
Aortic valve regurgitation ≥ moderate n(%)	0 (0)	13(14)	0.00000
Mitral valve regurgitation ≥ moderate n(%)	29 (50)	20 (22)	0.0006
Tricuspid valve regurgitation ≥ moderate n (%)	6 (10)	8 (9)	NS
Right ventricular systolic pressure (mmHg)	44 ± 11	38 ± 9	0.00001

4. Discussion

TAVR and SVR share a common feature by the fact that they both introduce foreign prosthetic material into the endocardial surface. As such they may create a nidus for infective endocarditis. In the largely revised infective endocarditis prevention guidelines of 2007 [1] {Wilson, 2007 #14} a careful preoperative dental evaluation was recommended so that required dental treatment may be completed whenever possible before cardiac valve surgical repair or replacement or repair of congenital heart disease. Such measures suggested that they may decrease the incidence of late prosthetic valve endocarditis caused by viridans group streptococci. IE has been reported to occur after TAVR at rates equal to or exceeding those associated with surgical aortic valve replacement (AVR) and was associated with a high 1-year mortality rate of 75% [12,13]. Treatment for periodontal disease had been reported in 70.5% of patients before valvular replacement [14].

In our study we have demonstrated that oral hygiene is similar and rather poor among candidates for TAVR and SVR, and requires specific treatment in most patients. While latest guidelines do suggest that post-operative IE prophylaxis and treatment should be delivered similarly in TAVR and SVR procedures [2,15], pre-operative dental screening and care is only recommended for surgery. The consequences of IE in patients undergoing TAVR are usually more catastrophic, as these patients were a-priori at higher risk due to co-morbidities and prior cardiovascular surgery that led to their allocation to trans-catheter treatment. Emergent re-do surgery for IE is a high risk procedure in all patients, and especially so in TAVR patients that were originally deferred from surgery deemed inoperable. Given that the probable oral source of infection was similar in patients prior to TAVR or SVR the importance of oral-dental clearance before TAVR is probably reasonable.

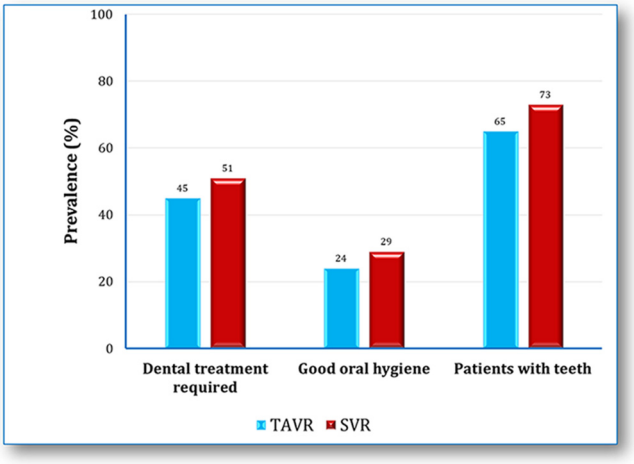

Fig. 1. Prevalence of oral findings in Valve replacement candidates Prevalence of teeth, good oral hygiene and need for dental treatment in the study cohort. TAVR denotes Transcatheter Aortic valve replacement, SVR – surgical valve replacement.

During follow-up extending from early to late IE timing we had one case of late IE in each in group. We cannot state that our intervention had any influence on IE rate as our incidence of IE prior the implementation of dental screening for TAVR was similar. Yet, in comparison to expected rates of IE with prosthetic/repaired valves and some recent publications showing increased risk after dental care [16] our approach seemed safe and probably effective.

Optimal IE prophylactic strategies for native valve pathologies have been continuously revaluated, like in the recent GAMES Spanish registry [17]. We believe that new policies should also be considered regarding pre-procedural dental evaluation for patients undergoing TAVR, and possibly all candidates for percutaneously implanted endovascular prosthetic materials.

5. Limitations

Our study represent our experience in one single tertiary cardiovascular center with relative low number of patients, rather short period of follow-up, and the low expected event rate the study was not powered to identify longitudinal advantages other than the safety of the oral-dental screening approach. Larger cohorts with longer follow-up should probably further be assessed.

6. Conclusions

Oral health and need for pre-procedural dental treatment were not different among candidates for SVR and TAVR. Thus in TAVR patients initially denied surgery due to higher operative risk IE preventive oral-dental care seems to be justified.

Conflict of interest

The authors report no relationships that could be construed as a conflict of interest

References

[1] W. Wilson, K.A. Taubert, M. Gewitz, P.B. Lockhart, L.M. Baddour, M. Levison, et al., Prevention of infective endocarditis: guidelines from the American Heart Association: a guideline from the American Heart Association Rheumatic Fever, Endocarditis, and Kawasaki Disease Committee, Council on Cardiovascular Disease in the Young, and the Council on Clinical Cardiology, Council on Cardiovascular Surgery and Anesthesia, and the Quality of Care and Outcomes Research Interdisciplinary Working Group, Circulation 116 (2007) 1736–1754.
[2] Nishimura RA, Otto CM, Bonow RO, Carabello BA, Erwin JP, 3rd, Fleisher LA, et al. 2017 AHA/ACC Focused Update of the 2014 AHA/ACC Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. Circulation. 2017;135:e1159-e95.
[3] Habib G, Lancellotti P, Antunes MJ, Bongiorni MG, Casalta JP, Del Zotti F, et al. 2015 ESC Guidelines for the management of infective endocarditis: The Task Force for the Management of Infective Endocarditis of the European Society of Cardiology (ESC). Endorsed by: European Association for Cardio-Thoracic Surgery (EACTS), the European Association of Nuclear Medicine (EANM). Eur Heart J. 2015;36:3075–128.
[4] I.J. Amat-Santos, H.B. Ribeiro, M. Urena, R. Allende, C. Houde, E. Bedard, et al., Prosthetic valve endocarditis after transcatheter valve replacement, a systematic review. JACC Cardiovasc Interv. 8 (2015) 334–346.
[5] I.J. Amat-Santos, D. Messika-Zeitoun, H. Eltchaninoff, S. Kapadia, S. Lerakis, A.N. Cheema, et al., Infective endocarditis after transcatheter aortic valve implantation: results from a large multicenter registry, Circulation. 131 (2015) 1566–1574.
[6] G.J. Debelian, I. Olsen, L. Tronstad, Anaerobic bacteremia and fungemia in patients undergoing endodontic therapy: an overview, Ann. Periodontol. 3 (1998) 281–287.
[7] P.B. Lockhart, M.T. Brennan, H.C. Sasser, P.C. Fox, B.J. Paster, F.K. Bahrani-Mougeot, Bacteremia associated with toothbrushing and dental extraction, Circulation. 117 (2008) 3118–3125.
[8] M. Barbosa, I. Prada-Lopez, M. Alvarez, B. Amaral, C.D. de los Angeles, I. Tomas, Post-tooth extraction bacteraemia: a randomized clinical trial on the efficacy of chlorhexidine prophylaxis, PLoS One 10 (2015), e0124249.
[9] F.K. Mougeot, S.E. Saunders, M.T. Brennan, P.B. Lockhart, Associations between bacteremia from oral sources and distant-site infections: tooth brushing versus single tooth extraction, Oral Surg. Oral Med. Oral Pathol. Oral Radiol. 119 (2015) 430–435.

[10] J.H.L.B. Catherine, L. Nawarocki, J.H. Torres, Recommendations on the Management of Oral Dental Foci of Infection. French Society of Oral Surgery, 2006.
[11] E. Cotti, M. Arrica, A. Di Lenarda, S.B. Serri, P. Bassareo, L. Padeletti, et al., The perioperative dental screening and management of patients undergoing cardiothoracic, vascular surgery and other cardiovascular invasive procedures: a systematic review, Eur. J. Prev. Cardiol. 24 (2017) 409–425.
[12] I.J. Amat-Santos, D. Messika-Zeitoun, H. Eltchaninoff, S. Kapadia, S. Lerakis, A.N. Cheema, et al., Response to letters regarding article, "infective endocarditis after transcatheter aortic valve implantation: results from a large multicenter registry", Circulation 132 (2015) e372–e374.
[13] N. Mangner, F. Woitek, S. Haussig, F. Schlotter, G. Stachel, R. Hollriegel, et al., Incidence, predictors, and outcome of patients developing infective endocarditis following transfemoral transcatheter aortic valve replacement, J. Am. Coll. Cardiol. 67 (2016) 2907–2908.
[14] J. Rustemeyer, A. Bremerich, Necessity of surgical dental foci treatment prior to organ transplantation and heart valve replacement, Clin. Oral Investig. 11 (2007) 171–174.
[15] A. Eisen, Y. Shapira, A. Sagie, R. Kornowski, Infective endocarditis in the transcatheter aortic valve replacement era: comprehensive review of a rare complication, Clin. Cardiol. 35 (2012) E1–E5.
[16] M.M. Smith, D.W. Barbara, W.J. Mauermann, C.F. Viozzi, J.A. Dearani, K.J. Grim, Morbidity and mortality associated with dental extraction before cardiac operation, Ann. Thorac. Surg. 97 (2014) 838–844.
[17] I. Zegri-Reiriz, A. de Alarcon, P. Munoz, M. Martinez Selles, V. Gonzalez-Ramallo, J.M. Miro, et al., Infective endocarditis in patients with bicuspid aortic valve or mitral valve prolapse, J. Am. Coll. Cardiol. 71 (2018) 2731–2740.