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Safety and efficacy of transcatheter edge-to-edge repair (TEER) in patients with history of cancer

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ABSTRACT

Background: Surgical therapy has been a long-standing option for valvular heart disease, in patients with history of cancer, it carries an increased risk of complications.
Objectives: Transcatheter edge-to-edge repair (TEER) for mitral regurgitation, represents a less invasive option. However, patients with history of cancer have generally been excluded from trials.
Methods: A retrospective cohort analysis was performed on de-identified, aggregate patient data from the TriNetX research network. Patients 18 ≥ years of age, who had undergone TEER between January 1, 2013 and May 19, 2021, were identified using the CPT codes and divided into two cohorts based on a history of cancer. Subgroup analysis was performed based on history of systemic antineoplastic therapy. Odds ratio and log-rank test were used to compare the outcomes over 1 and 12-months.
Results: In matched cohorts (503 patients in each, mean age 77.7 years, men 55 vs 58 %, white 84 vs 87 % in non-cancer and cancer cohorts respectively), the risk of heart failure exacerbation, all-cause mortality and all-cause hospitalizations were similar at 1 and 12 months among patients undergoing TEER. Risk of major complications (ischemic stroke, blood product transfusion and cardiac tamponade) were also similar. In the cancer cohort, hematologic/lymphoid malignancies were the most common (28.0 %) and 12.5 % patients had a history of metastatic cancer. There was no significant difference in heart failure exacerbation or all-cause mortality based on history of systemic antineoplastic therapy.
Conclusions: Overall outcomes following TEER are similar in patients with a history of cancer and should be considered in selected patients in this population.

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1. Introduction

Cancer and heart disease are primary drivers of morbidity and mortality globally [1]. Moreover, as cancer-specific mortality is now decreasing due to advances in current anti-neoplastic therapies and the surviving population is aging, the interplay between cancer and cardiovascular disease (CVD) is increasing [2–4]. While the overwhelming focus in patients with cancer has been on left ventricular systolic function, cancer is an increasingly common co-morbid condition among patients with valvular heart disease. In the cardio-oncology population, valvular pathology may be observed secondary to pre-existing valvular dysfunction, degenerative changes in the aging population, radiation therapy, infective endocarditis and left ventricular systolic dysfunction leading to secondary valvular dysfunction [4,5]. Additionally, valvular heart disease has been shown to have a more detrimental impact in patients with cancer with increased risks of hospitalization for heart failure exacerbation and poorer quality of life when compared with patients without cancer [3,6–8].

Although surgical valve repair or replacement has been a long-standing treatment option for patients with severe valvular heart disease, cardiac surgery in cancer patients carries an increased risk of complications due to a variety of reasons, including bone marrow suppression, increased susceptibility to infection and challenging anatomy secondary to radiation therapy [9,10]. Transcatheter interventions for valvular heart disease, such as transcatheter aortic valve replacement (TAVR) for aortic stenosis and transcatheter edge-to-edge repair (TEER) for mitral regurgitation, represent a less invasive option than surgical treatment. That said, patients with underlying cancer have generally been excluded from pivotal device trials and so data is limited in these populations. To address this gap in knowledge, we aimed to explore the utilization and associated outcomes of TEER in patients with severe mitral regurgitation and a history of cancer by leveraging the global Electronic Health Records (EHR) based database (TriNetX).

2. Methods

2.1. Data source and patient Population

The data used in this study was collected from the TriNetX Global Research Network, which provides access to EHR for approximately 250 million patients from more than 120 healthcare organizations, predominantly within the United States. Data displayed on the TriNetX Platform in the aggregate form, or any patient level data provided in a data set generated by the TriNetX Platform, contains only de-identified data as per the de-identification standard defined in Section §164.514(a) of the HIPAA Privacy Rule. Because this study used only de-identified patient records and did not involve the collection, use, or transmittal of individually identifiable data, Institutional Review Board approval is not required.

Data analysis was performed on May 19, 2022. Patients $\geq$ 18 years of age, who had undergone TEER between January 1, 2013 and May 19, 2021, were identified using the Current Procedural Terminology (CPT) codes for TEER. Patients were further identified as having a history of cancer using ICD-10 codes and were divided into two cohorts – cancer and non-cancer. The cancer cohort was identified based on the presence of ICD-10 codes associated with malignancy, regardless of type. The TriNetX dataset is not able to differentiate between active cancer and a history of cancer and, as such, this cohort contained a combination of the two. Among patients with a history of cancer (cancer cohort), further subgroup analysis was performed based on their history of systemic antineoplastic therapy, including chemotherapy, systemic radiation, hormonal or immunotherapy. Exposure to systemic antineoplastic therapy was pooled through validated methods from EHR. A detailed description of the CPT and ICD-10 codes used are available in the supplementary appendix. This study is reported as per the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines.

2.2. Study Endpoints

For comparison of cancer and non-cancer cohorts, the primary outcome was heart failure exacerbation defined as requiring intravenous diuretics during 12 months of follow-up. Secondary outcomes included all-cause mortality, blood product transfusion, ischemic stroke, all-cause hospitalization, or cardiac tamponade. All outcomes were assessed at 30-days and 12-months following the index TEER procedure.

For the subgroup analysis of cancer cohort based on patients with or without a history of systemic antineoplastic therapy, the primary outcome was heart failure requiring intravenous diuretic use. Secondary outcomes included all-cause mortality. Other secondary outcomes analyzed for a larger cohort comparison (cancer vs non-cancer) were not analyzed in this subgroup analysis due to the small number of patients, who experienced these outcomes.

2.3. Statistical Analysis

Baseline characteristics were compared between the cohorts using Chi-square (χ^2) tests for categorical variables and independent-sample t tests for continuous variables. To control for baseline differences in the patient cohorts, propensity-score matching (PSM) was used (greedy nearest-neighbor matching with a caliper of 0.1 pooled standard deviations). Covariates for matching included age, race, heart failure, hypertension, ischemic heart disease, hyperlipidemia, diabetes mellitus, atrial fibrillation, use of cardiovascular medications (β-blockers, diuretics, anti-lipemic agents, angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, sacubitril, antiplatelets and anticoagulants), NYHA class, left ventricular ejection fraction, laboratory data (creatinine, hemoglobin, platelets, sodium levels, cholesterol, hemoglobin A1c), blood pressure and BMI. These variables were chosen because of their potential impact on overall and cardiovascular outcomes. After matching, the goal was to have as many covariates as possible with a standardized mean difference of$<$0.1, which would indicate that there is no significant covariate imbalance.

Following propensity score matching, outcomes out to 12 months were compared between cancer and non-cancer cohorts. χ^2 test was used for testing the measures of association. We calculated odds ratio, relative-risk, and risk difference. Survival analysis was performed using Kaplan Meier curves using Log-Rank test. Hazard ratio and tests of proportionality were applied. Statistical significance was set at $P < 0.05$. Statistical analyses were performed using integrated R-for statistical computing on the TriNetX platform.

3. Results

3.1. Patient population

A total of 2,280 patients (1,767 patients without a history of cancer and 513 patients with a history of cancer) who had undergone TEER between January 1, 2013 and May 19, 2021 were identified. After PSM based on their covariates, 503 patients remained in each cohort and were included in our analysis (Fig. 2).

Table 1 shows the baseline characteristics of both cohorts before and after propensity matching. At baseline, patients in the cancer cohort were older (age: 77.8 +/- 9.5 vs 75.3 +/- 11.4 years, [Range: 18–90], $p < 0.001$) and had a higher proportion of whites (87.3 % vs 80.7 %, $p = 0.001$). Among cancer patients, hypertension (89.1 % vs 78.5 %, $p < 0.001$), lipoprotein disorders (72.9 % vs 65.5 %, $p = 0.002$), coronary artery disease (79.1 % vs 71.0 %, $p < 0.001$), and atrial fibrillation (70.4 % vs 62.4 %, $p = 0.001$) were more prevalent. A higher proportion of patients within the cancer group were on anticoagulant therapy compared to the non-cancer cohort (93.6 % vs 87 %, $p < 0.001$) The groups were well matched after PSM without any significant residual

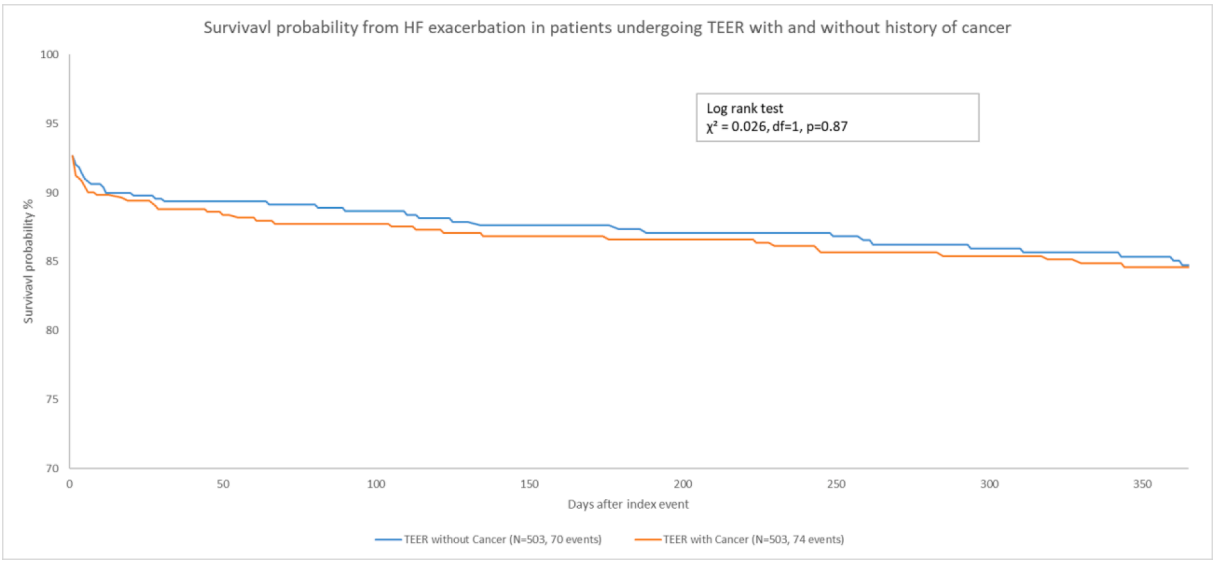

Fig. 1. Demonstrates a kaplan-meyer curve comparing heart failure exacerbation between the cancer and no cancer cohorts post teer procedure.

differences between two cohorts.

3.2. Outcomes

A total of 74 (14.7 %) cancer patients and 70 (13.9 %) met the primary endpoint of heart failure requiring intravenous diuretic use following TEER within the 12-month follow-up period. (Table 4.) In propensity matched cohorts, there was no significant difference in risk of heart failure requiring intravenous diuretic use at 12 months (OR: 0.937, 95 % CI: 0.65–1.33; p = 0.719). (Fig. 1). In propensity matched cohorts, there was no significant difference in risk of all-cause mortality at 12 months 16.3 % in cancer patients and 18.5 % in non-cancer patients (OR: 1.16, 95 % CI: 0.84–1.61; p = 0.36). All-cause hospitalizations was also similar between the two cohorts (52.7 % vs 46.7 %; OR: 0.78, 95 % CI: 0.61–1.00; p = 0.059). There was no significant difference in stroke, blood product transfusion or cardiac tamponade between the two cohorts at 30 days. These results were also replicated at the 12 month follow up period.

3.3. Effect of anti-Neoplastic therapy on outcomes after TEER

For patients in the cancer cohort, the cancer types, presence of metastatic disease and use of anti-neoplastic therapy are described in Tables 2 and 3. Hematologic and lymphoid malignancies was most common and noted in 28.0 % of the patients. A total of 63 (12.5 %) patients had a history of metastatic cancer at baseline and 14 (2.7 %) had a history of radiation therapy. A total of 107 patients were identified as having a history of systemic anti-neoplastic therapy.

Adjusted analyses demonstrated no significant difference heart failure exacerbation requiring intravenous diuretic use (22.4 % vs 13.1 % OR: 0.52, CI: 0.25–1.07, p0.08) or all-cause mortality (15.9 % vs14.0 % OR: 1.15, 95 % CI: 0.54–2.45; p = 0.19) in patients with a history of receiving anti-neoplastic therapy. (Table 4).

4. Discussion

This retrospective real-world study demonstrates that heart failure exacerbation requiring IV diuresis and all-cause mortality were similar at 1 year follow-up between patients with and without a history of cancer receiving TEER. Moreover, immediate and late procedure related complications, such as significant bleeding requiring transfusion, stroke, and cardiac tamponade were also similar between both the cohorts. These findings are of particular importance given the growing number of patients with prior malignancy that are affected by mitral regurgitation, many of whom are at prohibitive risk for cardiac surgery.

Prior short-term studies have suggested that patients with cancer undergoing TEER have acceptable outcomes in the short term. In a German registry of 828 patients who underwent TEER, 52 had a history of cancer. In this small population, patients with a history of cancer demonstrated improved clinical symptoms at 30 days after TEER and their co-morbid status did not appear to impact *peri*-procedural complications when compared to patients without a history of cancer [11]. In another retrospective study using the National Inpatient Sample (NIS) Database, 700 patients with a history of cancer demonstrated no difference in in hospital-mortality (1.4 % vs 1.8 %, p < 0.71), ischemic stroke (0.7 % vs 0.6 %, p < 0.97), major bleeding (8.6 % vs 10.9 %, p < 0.36), nursing home use (13.6 % vs 11.7 %, p < 0.48) or length of stay (1.1 vs 1.2, p < 0.60) when compared to a non-cancer propensity-matched group. Cost was the only statistically significant difference among the two groups, with cancer patients incurring a higher cost compared to their non-cancer counterparts ($52325 vs $48832, p < 0.0001). Conversely, in cancer patients who had undergone surgical mitral intervention, there was a significantly higher rate of major bleeding, lower rate of home discharge, and higher utilization of home health services compared to non-cancer patients [10].

Our findings add to the prior literature by demonstrating similar safety and efficacy of TEER out to 12 months in patients with and without cancer. A single center study of 446 TEER patients (82 with active or a history of cancer) found that cancer remained an independent predictor of one-year mortality using three different models [12]. Possible explanations for this finding included increased frailty in the cancer cohort, however other parameters were also noted to differ between the groups, including lower body mass index and higher levels of NT-proBNP in the cancer cohort, both of which are independent predictors of mortality in chronic heart failure [13,14]. Additionally, the increased mortality at 1 year appeared to be primarily driven by patients with active cancer. Our data however, does not discriminate between patients with active or history of cancer.

Since we were unable to determine the status of the patient's cancer in our study, it is possible that our study population is more representative of patient's with past cancer.

Our study also examined the unique endpoint of heart failure requiring intravenous diuresis. While heart failure hospitalizations have been identified as an important endpoint in many cardiac device and drug trials [15], the utilization of intravenous diuretics to treat decompensated heart failure in the outpatient setting has been

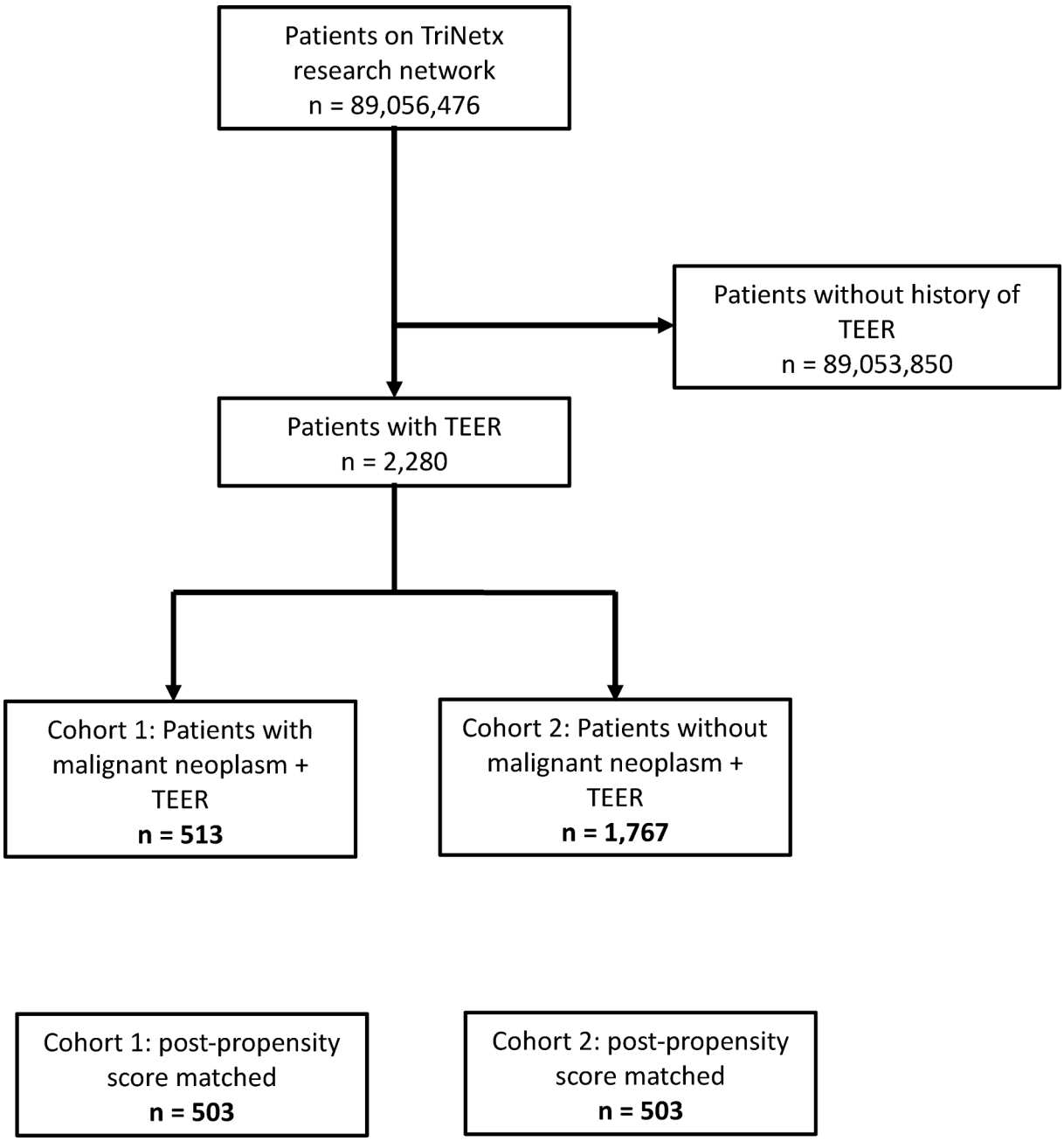

Fig. 2. Diagram of the cohorts identifying patients with TEER and a history of cancer undergoing analysis.

considered a safe and efficacious alternative strategy to hospitalization [16,17]. Therefore, in order to capture the true incidence of decompensated heart failure while still accounting for differences in practice patterns, the present study investigated the use of intravenous diuretics post-TEER as a surrogate for recurrent heart failure. Although overall all-cause hospitalizations were higher in cancer patients in our study, it is reassuring that no difference was found in intravenous diuretic use, suggesting that TEER led to the desired effect of reducing heart failure exacerbations in both the inpatient and outpatient setting.

Stroke remains an important safety parameter for TEER. Our study indicates that that the rate of 1-year stroke in both the cancer and non-cancer cohorts (3.9 % vs 2.2 %, OR: 0.56 CI: 0.25–1.26, p = 0.38) is also similar to what has been reported in both pivotal trials and registry based studies of this technology [15,18,19]. It is reassuring to see that stroke rates were not significantly different between the cohorts, suggesting that cancer status does not increase the risk of procedure-related stroke, and that stroke rates in our analytic cohort are similar to what has been previously seen [15,18,19]. With regards to 12-month stroke rates, our data source did not allow for identification of the exact etiology of the strokes. That said, it is worthwhile to note that the rate of pre-existing atrial fibrillation was substantially higher in our overall TEER final analytical cohort (70.4 % in the non-cancer cohort vs 62.4 % in the cancer cohort) when compared with other studies (57.3 % in the COAPT trial and 34 % in the Everest trial [15,18].

5. Limitations

Our findings should be viewed in light of several noteworthy limitations. First, data was obtained using EHR databases, which relies on administrative coding, and thus certain co-morbid health conditions may not be reliably reported. Second, outcomes that occurred outside the TriNetX database could not be captured, leading to a potential

Table 1
Baseline Patient Characteristics.

Before PSM				After PSM		
	TEER without Cancer N = 1767	TEER with Cancer N = 513	Standardized difference	TEER without Cancer N = 503	TEER with Cancer N = 503	Standardized difference
Baseline Characteristics						
Age	75.3 ± 11.4 years	77.80 ± 9.5 years	0.24	77.7 ± 9.9 years	77.7 ± 9.6 years	0.006
Male	942 (53.3 %)	287 (55.9 %)	0.29	275 (54.7 %)	279 (58.5 %)	0.01
White	1426 (80.7 %)	448 (87.3 %)	0.18	422 (83.9 %)	438 (87.1 %)	0.03
Black	167 (9.5 %)	35 (6.8 %)	0.09	40 (8.0 %)	35 (7 %)	0.03
Hispanic	100 (5.7 %)	12 (2.7 %)	0.14	13 (2.6 %)	14 (2.8 %)	0.01
Co-Morbid Conditions						
Hyperlipidemia	1157 (65.5 %)	374 (72.9 %)	0.16	359 (71.4 %)	2365 (72.6 %)	0.02
Hypertension	1387 (78.5 %)	457 (89.1 %)	0.29	435 (86.5 %)	447 (88.9 %)	0.07
Ischemic heart diseases	1255 (71.0 %)	3406 (79.1 %)	0.18	390 (77.5 %)	397 (78.9 %)	0.03
Atrial fibrillation and flutter	1103 (62.4 %)	361 (70.4 %)	0.16	342 (68.0 %)	353 (70.2 %)	0.04
Cardiomyopathy	537 (30.4 %)	200 (39.0 %)	0.18	194 (38.6 %)	192 (38.2 %)	0.008
Diabetes mellitus	531 (30.1 %)	200 (39.0 %)	0.03	146 (29.0 %)	158 (31.4 %)	0.05
Laboratory Data						
Creatinine	1.5 ± 1.3	1.4 ± 0.8	0.11	1.5 ± 1.2	1.4 ± 0.8	0.03
Hemoglobin	11.20 ± 2.4	11.1 ± 2.3	0.01	11.3 ± 2.3	11.2 ± 2.3	0.04
Sodium	138.5 ± 3.7	138.8 ± 3.8	0.06	138.6 ± 3.6	138.7 ± 3.8	0.03
Platelets	185.2 ± 69.0	187.7 ± 74.8	0.03	185.3 ± 68.7	187.7 ± 74.7	0.03
LDL	78.6 ± 32.8	81.4 ± 36.1	0.08	79.4 ± 33.00	81.8 ± 35.9	0.07
Hemoglobin A1c	6.1 ± 1.4	6.1 ± 1.5	0.03	6.1 ± 1.4	6.1 ± 1.5	0.04
BMI	27.3 ± 6.2	26.2 ± 6.4	0.17	27.2 ± 5.9	26.3 ± 6.3	0.15
LVEF ≤ 40 %	148 (8.4 %)	70 (13.6 %)	0.16	64 (12.7 %)	61 (12.1 %)	0.01
NYHA Classification	2.6 ± 0.7	2.8 ± 0.5	0.21	2.8 ± 0.6	2.8 ± 0.5	0.01
Medications						
Diuretics	1413 (80.0 %)	445(86.7 %)	0.18	437 (86.9 %)	435 (86.50 %)	0.01
Beta-Blockers	1373 (77.7 %)	435 (84.8 %)	0.18	414 (82.3 %)	425 (84.5 %)	0.05
Aspirin	1343 (76.0 %)	423 (82.5 %)	0.16	402 (79.9 %)	413 (82.1 %)	0.05
Anti-lipemic drugs	1153 (65.3 %)	357 (69.6 %)	0.09	355 (70.60 %)	348 (69.20 %)	0.03
Clopidogrel	894 (50.6 %)	264 (51.5 %)	0.01	274(54.50 %)	258 (51.30 %)	0.06
Ticagrelor	77 (4.4 %)	16 (3.1 %)	0.06	23 (4.6 %)	15 (3.00 %)	0.08
Prasugrel	21 (1.2 %)	10 (1.9 %)	0.06	10 (2.0 %)	10 (2.0 %)	<0.001
ACE Inhibitors	699 (39.6 %)	240 (46.8 %)	0.14	228 (45.3 %)	232 (46.1 %)	0.01
Angiotensin II Inhibitors	560 (31.7 %)	152 (29.6 %)	0.04	138 (27.4 %)	150 (29.8 %)	0.05
Sacubitril	154 (8.7 %)	37 (7.2 %)	0.05	32 (6.40 %)	37 (7.4 %)	0.03
Anticoagulants	1538 (87.0 %)	480 (93.6 %)	0.22	468 (93.0 %)	470 (93.4 %)	0.01

Demonstrates the baseline characteristics of the patients who underwent TEER in those without a malignancy history and those with a malignancy history. Patient characteristics are compared between two cohorts (No malignancy vs malignancy) before and after propensity score matching.
Abbreviations: ACE inhibitors, angiotensin converting enzyme inhibitors, ARB, Aldosterone receptor blockers, AF, Atrial fibrillation, BMI, Body Mass Index, CKD, Chronic kidney disease, HBA1c, Hemoglobin A1c, LDL, Low Density Lipoprotein, LVEF, Left Ventricular Ejection Fraction.

Table 2
Cancer characteristics.

Cancer type based on ICD code	Cancer cohort n = 503
Hematologic or lymphatic malignancy	144 (28.0 %)
Melanoma and other malignant neoplasms of skin	88 (17.5 %)
Malignant neoplasms of male genital organs	56 (11.1 %)
Malignant neoplasms of breast	58 (11.5 %)
Metastatic Disease	63 (12.5 %)
Malignant neoplasms of urinary tract	25 (5.0 %)
Malignant neoplasms of respiratory and intrathoracic organs	28 (5.6 %)
Malignant neoplasms of digestive organs	60 (11.9 %)
Malignant neoplasms of female genital organs	15 (3.0 %)

Delineates the type of cancer by frequency in those who had undergone TEER with a history of cancer.

underestimation of events. That said, it is expected that this limitation would affect both cancer and non-cancer patients equally and thus should not affect the relative comparisons between these two groups. Third, the TriNetX dataset is unable to differentiate between active cancer and a history of cancer. Since patients with active cancer may have worse outcomes, we are unable to conclude that patients with active cancer will have similar outcomes after TEER as compared to patients without cancer or patients who are cancer survivors. Nevertheless, it is reassuring that our exploratory subgroup analysis did not demonstrate a significant difference in mortality in patients with a history of anti-neoplastic treatment vs those without. Fourth, the TriNetX platform does not accurately provide the number of events if an event occurred in<10 patients to protect patient privacy and prevent deidentification. Lastly, although we were able to account for the different kinds of cancer represented, the numbers were small and no conclusions can be drawn regarding the outcomes of TEER in specific types of cancers.

6. Conclusions

In summary, using a global federated health research network, we demonstrated that the 1- year outcomes following TEER are similar in patients with cancer when compared to propensity-matched patients without cancer. These findings are encouraging and suggest that TEER should be considered in selected patients in this high-risk population. Larger prospective studies are needed to reproduce these findings and better characterize cancer-specific risk factors of adverse outcomes after TEER.

Disclosures

The authors have no relevant financial disclosures to report.

Tweet

Outcomes following TEER are similar in patients with a history of

Table 3
Baseline characteristics of those with history of antineoplastic therapy vs no antineoplastic therapy.

	Before PSM			After PSM		
	No antineoplastic therapy N = 402	Antineoplastic therapy N = 111	Standardized difference	No antineoplastic therapy N = 107	Antineoplastic therapy N = 107	Standardized difference
Baseline Characteristics						
Age	78.2 ± 9.4	76.5 ± 9.9	0.17	78.1 ± 9.6	77.3 ± 8.9	0.08
Male	231 (57.5 %)	56 (50.5 %)	0.14	49 (45.8 %)	54 (50.5 %)	0.09
Female	171 (42.5 %)	55 (49.5 %)	0.14	58 (54.2 %)	53 (49.5 %)	0.09
White	352 (87.6 %)	96 (86.5 %)	0.03	94 (87.9 %)	93 (86.90 %)	0.02
Asian	10 (2.5 %)	10 (9.0 %)	0.28	10 (9.3 %)	10 (9.3 %)	<0.001
Black	29 (7.2 %)	10 (9.0 %)	0.06	10 (9.3 %)	10 (9.3 %)	<0.001
Hispanic	10 (2.5 %)	10 (9.0 %)	0.28	10 (9.3 %)	10 (9.3 %)	<0.011
Not Hispanic	371 (90.52 %)	101 (92.3 %)	0.04	98 (91.6 %)	99 (92.5 %)	0.03
Co-Morbid Conditions						
Hyperlipidemia	286 (79.3.%)	76 (68.5 %)	0.18	83 (77.6 %)	85 (79.4 %)	0.04
Hypertensive diseases	350 (87.1 %)	107 (96.4 %)	0.34	104 (97.2 %)	103 (96.2 %)	0.05
Ischemic heart diseases	316 (76.8 %)	90 (81.1 %)	0.06	86 (80.4 %)	88 (82.2 %)	0.04
Atrial fibrillation and flutter	285 (70.9 %)	76 (68.5 %)	0.05	81 (75.7 %)	75 (70.1 %)	0.12
Cardiomyopathy	157 (39.1 %)	43 (38.7 %)	0.006	37 (34.6 %)	42 (39.3 %)	0.09
Diabetes mellitus	121 (30.1 %)	42 (37.8 %)	0.16	33 (30.8 %)	40 (37.4 %)	0.13
Laboratory Data						
Creatinine	1.4 ± 0.8	1.3 ± 0.7	0.16	1.3 ± 0.6	1.2 ± 0.60	0.14
Hemoglobin	11.0 ± 2.4	11.2 ± 2.2	0.09	11.1 ± 2.3	11.1 ± 2.4	0.02
Sodium	138.9 ± 3.9	138.4 ± 3.7	0.13	139.0 ± 3.6	138.5 ± 3.6	0.215
Platelets	188.4 ± 74.6	185.67 ± 75.7	0.03	193.4 ± 78.0	187.3 ± 75.9	0.07
LDL	81.5 ± 37.5	81.2 ± 32.3	0.009	81.3 ± 40.2	81.90 ± 32.3	0.01
Hemoglobin A1c	6.0 ± 1.1	6.3 ± 2.2	0.18	6.0 ± 0.8	6.3 ± 2.3	0.18
BMI	26.3 ± 6.3	25.9 ± 6.7	0.06	25.9 ± 6.4	25.6 ± 6.5	0.03
LVEF ≤ 40 %	54 (14.4 %)	16 (14.4 %)	0.02	16 (15.0 %)	15 (14.0 %)	0.02
Medications						
Diuretics	345 (85.8 %)	100 (90.10 %)	0.13	99 (92.5 %)	96 (89.7 %)	0.09
Beta Blockers	337 (83.8 %)	98 (88.3 %)	0.12	97 (90.7 %)	94 (87.9 %)	0.09
Antilipemic agents	280 (69.7 %)	77 (69.4 %)	0.006	75 (70.1 %)	75 (70.1 %)	<0.001
ACEI	180 (44.80 %)	60 (54.1 %)	0.18	56 (52.3 %)	58 (54.2 %)	0.03
ARB	121 (30.1 %)	31 (27.9 %)	0.04	29 (27.1 %)	31 (29.0 %)	0.04
Sacubitril	29 (7.2 %)	10 (9.0 %)	0.06	10 (9.30 %)	10 (9.30 %)	<0.001
Anticoagulants	373 (92.8 %)	107 (96.4 %)	0.16	101 (94.4 %)	103 (96.3 %)	0.08

Demonstrates the baseline characteristics of the patients who had cancer and underwent TEER along with a history of receiving antineoplastic therapy Patient characteristics are compared between two cohorts (Antineoplastic therapy vs No antineoplastic therapy) before and after propensity score matching.
Abbreviations: ACE inhibitors, angiotensin converting enzyme inhibitors, ARB, Aldosterone receptor blockers, AF, Atrial fibrillation, BMI, Body Mass Index, CKD, Chronic kidney disease, HBA1c, Hemoglobin A1c, LDL, Low Density Lipoprotein, LVEF, Left Ventricular Ejection Fraction.

Table 4
Outcomes at 30 days and 12 months.

Outcome	30 days			12 months		
	TEER without cancer = 503	TEER with cancer = 503	P-value	TEER without cancer = 503	TEER with cancer = 503	p-value
HF exacerbation	52 (10.3 %)	56 (11.1 %)	0.68	70 (13.9 %)	74 (14.7 %)	0.72
All-cause mortality	27 (5.4 %)	19 (3.8 %)	0.23	93 (18.5 %)	82 (16.3 %)	0.36
Blood product transfusion	10 (2.0 %)	10 (2.0 %)	1.00	13 (2.6 %)	21 (4.2 %)	0.16
Ischemic Stroke	10 (2.0 %)	10 (2.0 %)	0.86	10 (2.0 %)	16 (3.2 %)	0.16
Cardiac tamponade	10 (2.0 %)	10 (2.0 %)	1.00	10 (2.0 %)	10 (2.0 %)	1.00
All-cause hospitalization	147 (29.2 %)	152 (30.2 %)	0.73	235 (46.7 %)	265 (52.7 %)	0.06
Subgroup analysis at 12 month						
	No anti-neoplastic therapy = 107		Antineoplastic therapy = 107			p-value
HF exacerbation	24 (22.4 %)		14 (13.0 %)			0.09
All-cause mortality	15 (14.0 %)		17 (15.9 %)			0.19

Compares the primary and secondary outcomes based upon a history of cancer. The outcomes are compared at 30 days and out to 12 months from the index procedure.

cancer and should be considered in selected patients.

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Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.ijcha.2022.101165.

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