Socioeconomic and Demographic Predictors of Transarterial Chemoembolization Outcomes for Hepatic Malignancies

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Background & Purpose

Background

- Healthcare disparities remain a significant obstacle to the delivery of healthcare in the United States and many of these inequities remain underexplored within the field of interventional radiology (IR)
- Disparities exist across the breadth of procedural interventions in IR, including transarterial chemoembolization (TACE), related to race, insurance status, and patient geography (1)
- Although studies investigating TACE-associated disparities remain limited, one study found that Native American & Hispanic patients were less likely to undergo TACE than non-Hispanic white patients (2), while another study found that patients from large population centers were more likely to undergo TACE (3)
- The Social Vulnerability Index (SVI), developed by the Centers for Disease Control (CDC), is a measurement tool that assesses and quantifies the vulnerability of communities based on socioeconomic factors
- Recently, SVI has been investigated as a marker of disparate outcomes (4). For example, greater social vulnerability has been linked to increased risk of adverse postoperative outcomes after several common oncologic procedures (5) as well as increased surgical site infections among pediatric patients presenting with traumatic injury (6)

Purpose

This study aimed to evaluate socioeconomic and demographic factors that predict overall survival (OS) and progression free survival (PFS) of patients undergoing transarterial chemoembolization (TACE) for primary and metastatic hepatic disease.

Methods

- Retrospective review from 2016 to 2022 identified 322 patients with HCC (n =234) and metastatic liver lesions (n=98) treated with TACE
- Patients were stratified by demographics (Table 1A), including social vulnerability index (SVI), a CDC composite measure based on 16 variables from geographic census data (Table 1B)
- Primary outcome measures, overall survival (OS) & progression-free survival (PFS), were assessed using correlation, multivariate regression, and Kaplan Meier survival analyses
- Data regarding underlying disease characteristics such as tumor size, Model for End Stage Liver Disease (MELD) score, and ECOG status were collected for further analysis

Table 1: (A) Baseline patient demographics. (B) Socioeconomic variables included in SVI

A

Demographic		ALL (N=332)	Metastatic disease (N=98)	HCC (N=234)
Age		64 (59, 70)	63 (56, 70)	64 (60, 69)
Sex	M	224 (67.47%)	39 (39.8%)	185 (79.06%)
	F	108 (32.53%)	59 (60.2%)	49 (20.94%)
Race	White	283 (85.24%)	91 (92.86%)	192 (82.05%)
	African-American	35 (10.54%)	4 (4.08%)	31 (13.25%)
	Asian	6 (1.81%)	1 (1.02%)	5 (2.14%)
	Other	7 (2.11%)	2 (2.04%)	5 (2.14%)
	Hispanic	1 (0.3%)	0 (0%)	1 (0.43%)
Insurance type	Medicare	207 (62.35%)	60 (61.22%)	147 (62.82%)
	Private	64 (19.28%)	29 (29.59%)	35 (14.96%)
	Medicaid	61 (18.37%)	9 (9.18%)	52 (22.22%)
Employment	Retired	163 (49.1%)	48 (48.98%)	115 (49.15%)
	Employed	71 (21.39%)	34 (34.69%)	37 (15.81%)
	Disabled	63 (18.98%)	9 (9.18%)	54 (23.08%)
	Inmate	4 (1.2%)	0 (0%)	4 (1.71%)
	Unemployed	31 (9.34%)	7 (7.14%)	24 (10.26%)
Charlson co-morbidity	1-5	21 (6.3 %)	0 (0 %)	21 (9.0%)
	6-10	288 (86.7%)	90 (90.8 %)	198 (84.6 %)
	11-15	23 (6.9%)	8 (9.2 %)	15 (6.4%)

B

SVI
Single-Parent Households
English Language Proficiency
Racial & Ethnic Minority Status
Below 150% Poverty Level
Unemployed
Housing Cost Burden
No High School Diploma
No Health Insurance
Age 65 or Older
Age 17 or Younger
Civilian with Disability
Multi-Unit Structure
Mobile Homes
Crowding
No Vehicle
Group Quarters

Results

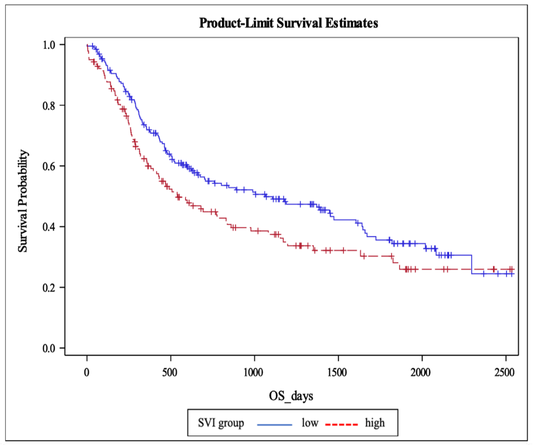

Figure 1. Kaplan Meier curve demonstrating overall survival in days with low (lower 50% SVI of studied population defined as SVI score < 0.66) and high SVI groups (higher 50% of SVI of studied population, defined as SVI> or = 0.66). Curves demonstrate decreased survival in the high vs. low vulnerability group across spectrum of short- and longer-term survival (p=0.03).

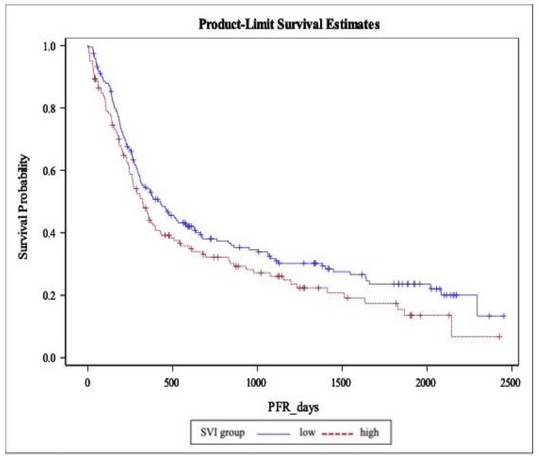

Figure 2. Kaplan Meier curve demonstrating progression-free survival in days with low (lower 50% SVI of studied population defined as SVI score < 0.66) and high SVI groups (higher 50% of SVI of studied population, defined as SVI> or = 0.66). Curves highlight a trend of decreased survival in the high vs. low vulnerability group (p=0.07).

Table 2. Analysis of maximum likelihood estimates

Multi-variate Analysis				
	OS		PFS	
	P-value	HR	P-value	HR
SVI	0.0108	3.880	0.1202	1.702
Tumor Size	< 0.0001	1.131	0.0005	1.078
Transplant	< 0.0001	0.130	< 0.0001	0.172
HCC	< 0.0001	3.015	0.0004	1.799
Charlson CI	0.7094	1.023		

Results cont.

- Mean OS for all patients was 770.64 days. Mean PFS for all patients was 596.91 days
- SVI is associated with overall survival among SVI groups throughout the length of the Kaplan Meier curve (p = 0.0333)
- Multivariate analysis significant association between SVI and overall survival (HR 3.880, p = 0.0108)
- HCC status is strongly and independently associated with overall survival (HR 3.015, p < 0.0001) and progression free survival (hazard ratio 1.799, p = 0.0004)
- Higher SVI (more vulnerability) is weakly but statistically significantly associated with higher MELD score (r = 0.1566, p = 0.0042)
- Higher zip code income is associated with lower MELD score (r = -0.24084, p < 0.0001)
- Notably, Charlson comorbidity index was not associated with OS (HR 1.023, p = 0.7094)

Discussion

- Social vulnerability index (SVI) independently correlated with overall survival in patients undergoing TACE across a wide spectrum of patients regardless of underlying disease characteristics/ severity and co-morbidities
- A comparable trend was noted between SVI and PFS .
- Findings highlight underexplored relationships between social factors and treatment outcomes, revealing potential use of SVI as a predictive factor of overall survival following TACE.
- SVI identifies high-risk geographic areas suggesting the potential use of SVI as a tool in determining preventative resource allocation for TACE patients.
- Development of discrete geographically targeted interventions for post-TACE follow-up may improve outcomes after TACE.

Conclusion

- Social and demographic factors remain an underexplored topic in interventional oncology. Further study is needed to help develop mitigation strategies to reduce healthcare disparities

References

1. Trivedi PS, Guerra B, Kumar V, Akinwande G, West D, Abi-Jaoudeh N, Salazar G, Rochon P. Healthcare Disparities in Interventional Radiology. J Vasc Interv Radiol. 2022 Dec;33(12):1459-1467.e1. doi: 10.1016/j.jvir.2022.08.026. Epub 2022 Sep 2. PMID: 36058539.
2. Alkhalili E, Greenbaum A, Luo L, et al. Racial disparities in treatment and survival of hepatocellular carcinoma in native americans and hispanics. Am J Surg. 2017;214(1):100-104. doi: 10.1016/j.amjsurg.2016.09.033.
3. Yu IS, Liu SL, Zaborska V, et al. The impact of geography in hepatocellular carcinoma: A retrospective population based study. Curr Oncol. 2021;28(1):396-404. doi: 10.3390/curroncol28010042.
4. Tran T, Rousseau MA, Farris DP, Bauer C, Nelson KC, Doan HQ. The social vulnerability index as a risk stratification tool for health disparity research in cancer patients: a scoping review. Cancer Causes Control. 2023 May;34(5):407-420. doi: 10.1007/s10552-023-01683-1.
5. Hyer JM, Tsilimigras DI, Diaz A, et al. High social vulnerability and "textbook outcomes" after cancer operation. J Am Coll Surg. 2021;232(4):351-359. doi: 10.1016/j.jamcollsurg.2020.11.024.
6. Stevens J, Reppucci ML, Pickett K, et al. Using the social vulnerability index to examine disparities in surgical pediatric trauma patients. J Surg Res. 2023;287:55-62. doi: 10.1016/j.jss.2023.01.013.