

Associations of Pre-Existing Vascular Risk Factors with Outcomes after Traumatic Brain Injury: A TRACK-TBI Study

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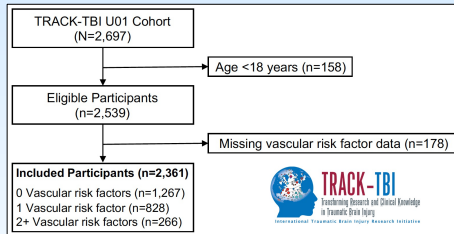
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Background / Objective

- The identification of potentially modifiable factors associated with traumatic brain injury (TBI) recovery is needed to improve TBI outcomes.
- Our objective was to evaluate associations of pre-injury vascular risk factors with TBI outcomes.

Methods

- Study Design:** Prospective study of 2,361 acute TBI patients enrolled in the Transforming Research and Clinical Knowledge in TBI (TRACK-TBI) Study.



- Vascular Risk Factors:** Hypertension, diabetes, hyperlipidemia, and current smoking were assessed at baseline using self- or proxy-report questions and medical chart review
- Outcomes:** Assessed over 6-months.
 - Glasgow Outcome Scale-Extended (GOSE)
 - Rivermead Post-Concussion Symptoms Questionnaire (RPQ)
 - Satisfaction with Life Scale (SWLS)
 - 18-Item Brief Symptom Inventory (BSI-18)
- Statistical Analyses:**
 - To evaluate associations of each individual vascular risk factor and number of vascular risk factors (0, 1, 2+) with outcomes, adjusted logistic regression was used for GOSE score 1-6 versus 7-8 and adjusted linear regression was used for RPQ, SWLS, and BSI-18 scores.
 - Multiple imputation by chained equations was used to account for missing covariate data and propensity weighting was used to account for missing outcome data.

Results

Table 1. Baseline Participant Characteristics, Overall and Stratified by Number of Vascular Risk Factors.

	Overall (N=2,361)	0 Vascular Risk Factors (n=1,267)	1 Vascular Risk Factor (n=828)	2+ Vascular Risk Factors (n=266)
Age (years), mean	42	39	41	60
Female, %	31	33	28	31
White Race, %	78	79	77	77
Hispanic Ethnicity, %	20	22	18	17
Mild TBI, %	81	81	81	80
Major Extracranial Injury, %	20	20	20	20
<High School Education, %	17	13	23	18
Full-time Employment, %	58	61	59	40
Depression/Anxiety	20	16	23	24
Prior TBI, %	30	30	35	22
Hypertension, %	17	0	10	89
Diabetes, %	8	0	7	52
Hyperlipidemia, %	6	0	4	44
Current Smoking, %	29	0	70	40

Table 2. Associations of Individual Vascular Risk Factors with 6-Month Outcomes.

	Hypertension	Diabetes	Hyperlipidemia	Current Smoking
GOSE, OR (95% CI)	1.16 (0.84, 1.62)	1.02 (0.68, 1.54)	0.89 (0.56, 1.40)	1.49 (1.15, 1.94)
RPQ, B (95% CI)	2.43 (0.46, 4.39)	2.71 (0.29, 5.14)	1.34 (-1.37, 4.05)	3.25 (1.70, 4.80)
SWLS, B (95% CI)	-0.87 (-2.08, 0.33)	-0.58 (-2.08, 0.92)	1.31 (-0.35, 2.97)	-1.72 (-2.66, -0.77)
BSI-18, B (95% CI)	2.31 (0.69, 3.93)	1.81 (-0.19, 3.80)	0.16 (-2.07, 2.39)	2.36 (1.09, 3.63)

Model adjusted for age, sex, race, ethnicity, TBI severity, education, employment status, alcohol consumption, illicit drug use, history of depression/anxiety, and prior TBI. Higher scores on the GOSE indicate better functional recovery. Higher scores on the RPQ indicate more severe symptoms. Higher scores on the SWLS indicate greater life satisfaction. Higher scores on the BSI-18 indicate more severe psychological symptoms.

Table 3. Associations of Number of Vascular Risk Factors with 6-Month TBI Outcomes.

	0 Vascular Risk Factors	1 Vascular Risk Factor	2+ Vascular Risk Factors
GOSE, OR (95% CI)	1 (Reference)	1.36 (1.07, 1.74)	1.23 (0.84, 1.83)
RPQ, B (95% CI)	0 (Reference)	2.04 (0.60, 3.47)	4.45 (2.14, 6.77)
SWLS, B (95% CI)	0 (Reference)	-0.89 (-1.77, -0.02)	-1.38 (-2.81, 0.05)
BSI-18, B (95% CI)	0 (Reference)	1.82 (0.64, 3.00)	3.44 (1.54, 5.35)

Model adjusted for age, sex, race, ethnicity, TBI severity, education, employment status, alcohol consumption, illicit drug use, history of depression/anxiety, and prior TBI. Higher scores on the GOSE indicate better functional recovery. Higher scores on the RPQ indicate more severe symptoms. Higher scores on the SWLS indicate greater life satisfaction. Higher scores on the BSI-18 indicate more severe psychological symptoms.

Results

Figure 1. Patterns of Vascular Risk Factors Among Study Participants With at Least 1 Vascular Risk Factor.

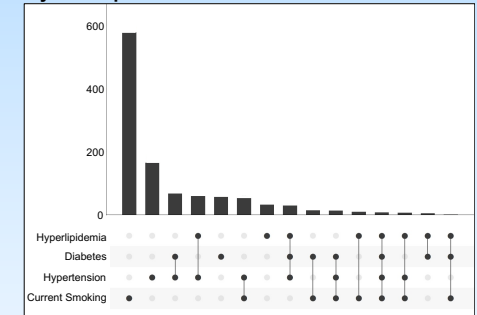
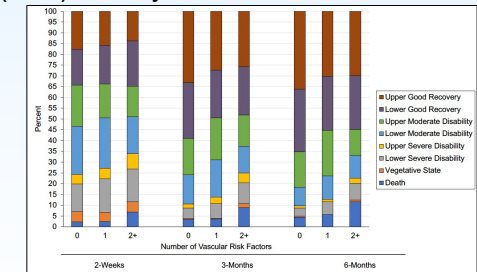


Figure 2. Propensity Weighted Distribution of 2-Week, 3-Month, and 6-Month Glasgow Outcome Scale Extended (GOSE) Scores by Number of Vascular Risk Factors.



P-value for interaction by time = 0.009.

Discussion

- Our study found that pre-injury vascular risk factors, especially smoking, are associated with worse outcomes after TBI.
- Aggressive post-injury treatment of vascular risk factors may be a promising strategy to improve TBI outcomes.