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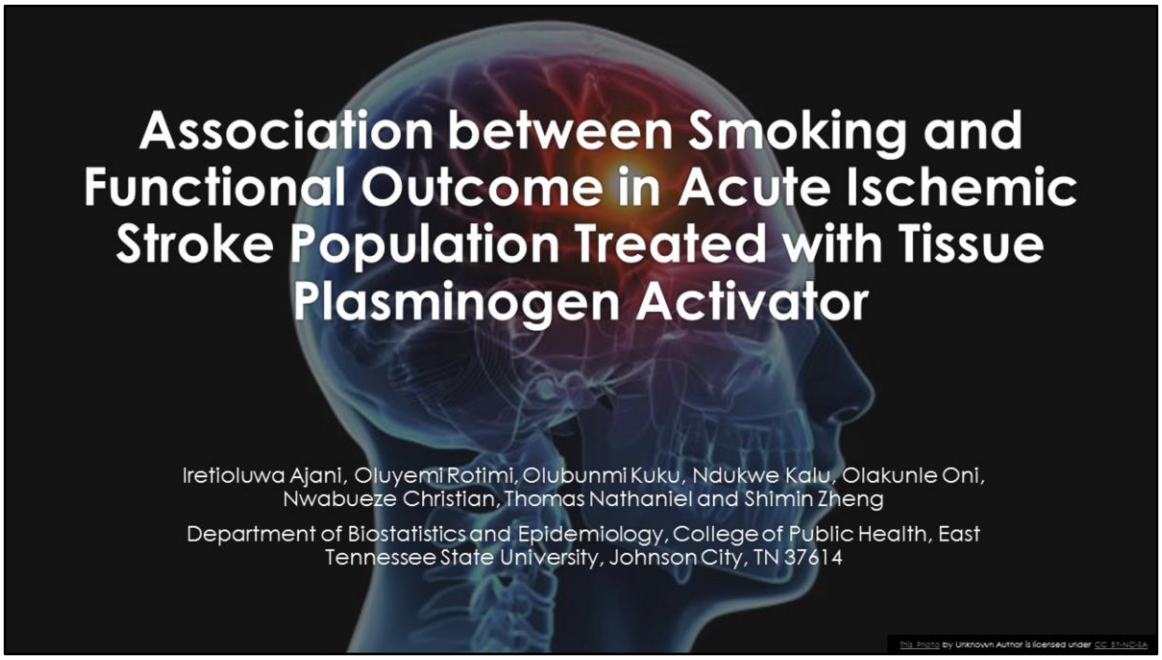
Association between Smoking and Functional Outcome in Acute Ischemic Stroke Population Treated with Tissue Plasminogen Activator
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OUTLINE

- Background
- Methods
- Results
- Discussion
- Conclusion

Background

- Stroke is the fifth leading cause of death in America and is a major cause of disability among adults.[1]
- 87% of all stroke cases are Ischemic strokes[1]

Ischemic strokes which happen when the artery that supplies blood to that part of the brain gets blocked; this blockage is often due to blood clots.3

Background

- Tissue Plasminogen Activator (tPA) is a thrombolytic agent used to treat ischemic type stroke[2]

- Several studies show an association between smoking and lower mortality rates[2,3]

Background

- Barua et al hypothesized that cigarette smoke exposure changes clot dynamics and the fibrin structure making clot more susceptible to tPa treatment.[3]
- Other studies didn't find such association and some even found poorer outcomes in smokers.

While it is common knowledge that smoking cigarette increases the risk of having a stroke,4 several studies have shown an association between smoking and lower mortality rate in patients treated with tPA.5–8 There are theories that explain this smoking-thrombolytic paradox based on clot formation. A study on the effects of smoking on clot formation found that cigarette smoke exposure changes clot dynamics and the fibrin structure.9 It increases the formation of fibrin-rich blood clots due to increase platelet activation and higher intra-arterial fibrinogen and fibrin concentrations, thus a smokers blood is in a hypercoagulable state.9,10 This makes the clots more susceptible to tPA treatments when compare with clots that are formed through other means.4,11 Other studies didn't find such association and some even found poorer outcomes in smokers as compared to non-smokers. 12,13

Background

- This study seeks to determine the association between smoking and functional improvement in stroke cases treated with tPA and stroke cases not that did not receive tPA treatment.

METHODS

- Study Population

All consecutive acute ischemic stroke patient admitted in the Greenville Health System between February 2010 and June 2016.

Smoking habits were assessed by a stroke neurologist within 24 h after admission. Current smoking was defined as smoking at least one cigarette per day. No smoking was considered present if the patient had never smoked.

Inclusion Criteria

Patients treated with tPA and patients admitted within 6 hours after stroke onset not treated with tPA were included in this study.

Sample Size

A total of 1,446 stroke patients were admitted during the time period, 379 smokers and 1067 non-smokers.

Outcome Variable

- Favorable outcome was defined as Modified Ranking Scale (mRS) of 0 or 1
- Unfavorable outcome was defined as mRS of 2-6

Statistical analysis

- We compared functional outcome and predictor variable using Univariate analyses.
- Fisher's exact test and Pearson's chi-square test were used for categorical variables.
- Logistic regression analyses were performed with favorable outcome (mRS 0–1) vs unfavorable outcome (mRS 2–6) as dependent variable.
- Variables from the univariate analysis were included in the final model based on a cut point p-value of 0.2 and an absence of multi collinearity.

RESULT

Table 1. Characteristics of smoking and non-smoking stroke patients treated with tPA or stroke patients admitted within 6 h after stroke onset not treated with tPA

	tPA			no tPA		
Smoking status	Smokers	Non-smokers	P-value	Smokers	Non-smokers	P-value
No of patients	181	414		198	653	
Age Group(Mean ± SD)	56.69 ± 12.25	69.60 ± 14.36	< 0.0001*	59.52 ± 11.84	73.15 ± 14.05	< 0.0001*
Race: No. (%)			0.0408*			0.0055*
Caucasian	136 (75.14)	345 (83.33)		147 (74.24)	529 (81.01)	
African-American	44 (24.31)	65 (15.70)		51 (25.76)	112 (17.15)	
Other	1 (0.55)	4 (0.97)		0 (0.00)	12 (1.84)bh	
Gender: No. (%)			0.0083*			< 0.0001*
Male	110 (60.77)	203 (49.03)		123 (62.12)	276 (42.27)	
Female	71 (39.23)	211 (50.97)		75 (37.88)	377 (57.73)	
Body Mass Index (Mean ± SD)	28.11 ± 6.60	29.14 ± 6.70		27.98 ± 8.51	28.34 ± 7.14	
MRS			0.0097*			0.0045*
Favorable Outcome	124 (68.51)	237 (57.25)		107 (54.04)	278 (42.57)	
Unfavorable Outcome	57 (31.49)	177 (42.75)		91 (45.96)	375 (57.43)	
Risk of Mortality GWTG Ischemic Stroke (Mean ± SD)	4.46 ± 4.41	6.11 ± 6.2		3.66 ± 3.92	5.39 ± 5.91	

Simple Logistic Regression Analysis of Smoking

- In tPA group, smokers are 63% more likely to improve when compared with non-smokers. (OR=1.63; CI=1.12-2.35; p-value=0.01)
- In no tPA group, smokers are 59% more likely to improve when compared to non smoker (OR=1.59; CI=1.15-2.18; p-value <0.01)

Table 2: Multiple Logistic regression analysis with mRS 0–1 or 2–6 as dependent variable among stroke patients treated with tPA

AUC = 72.18	Adjusted Odds Ratio	95% CI	p
Smoking	0.887	0.569- 1.383	0.596
Age	0.954	0.940- 0.969	<.0001
Sex (M vs F?)	0.767	0.533- 1.105	0.155
NIH scale	0.938	0.912- 0.965	<.0001
BMI	1.008	0.979- 1.037	0.5943

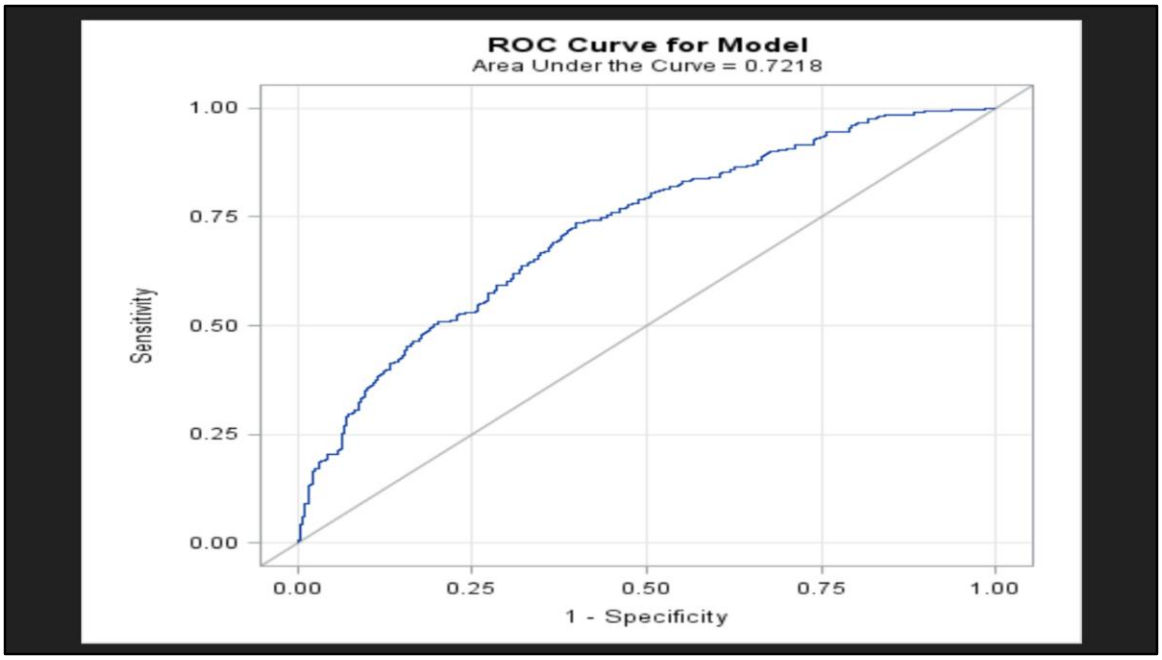
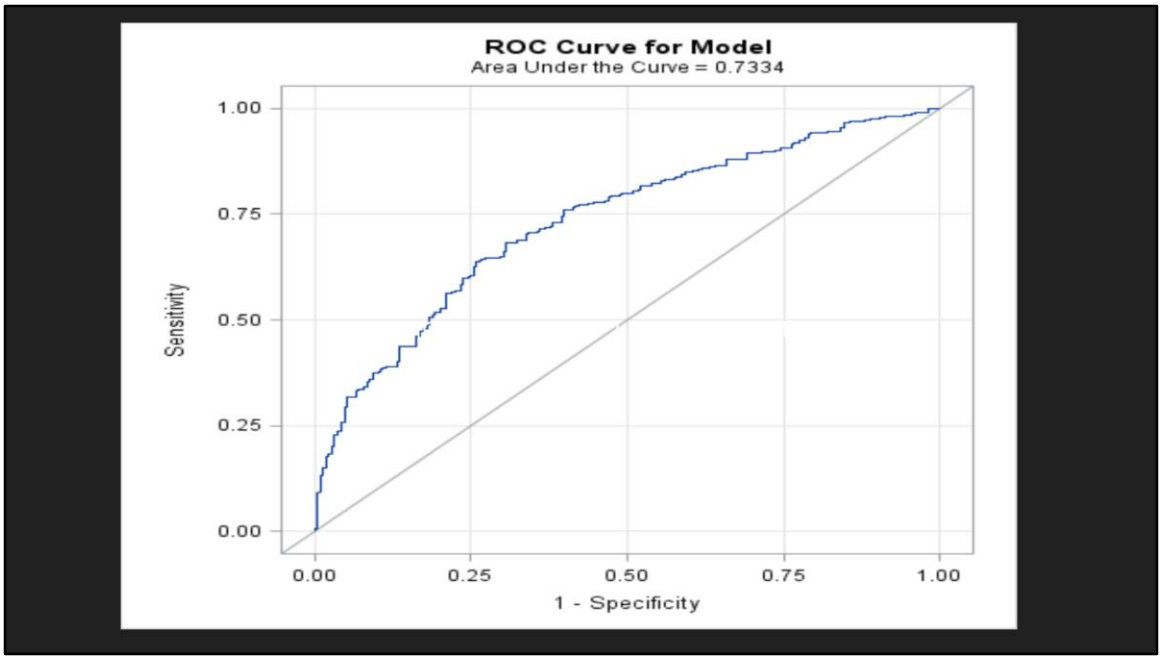
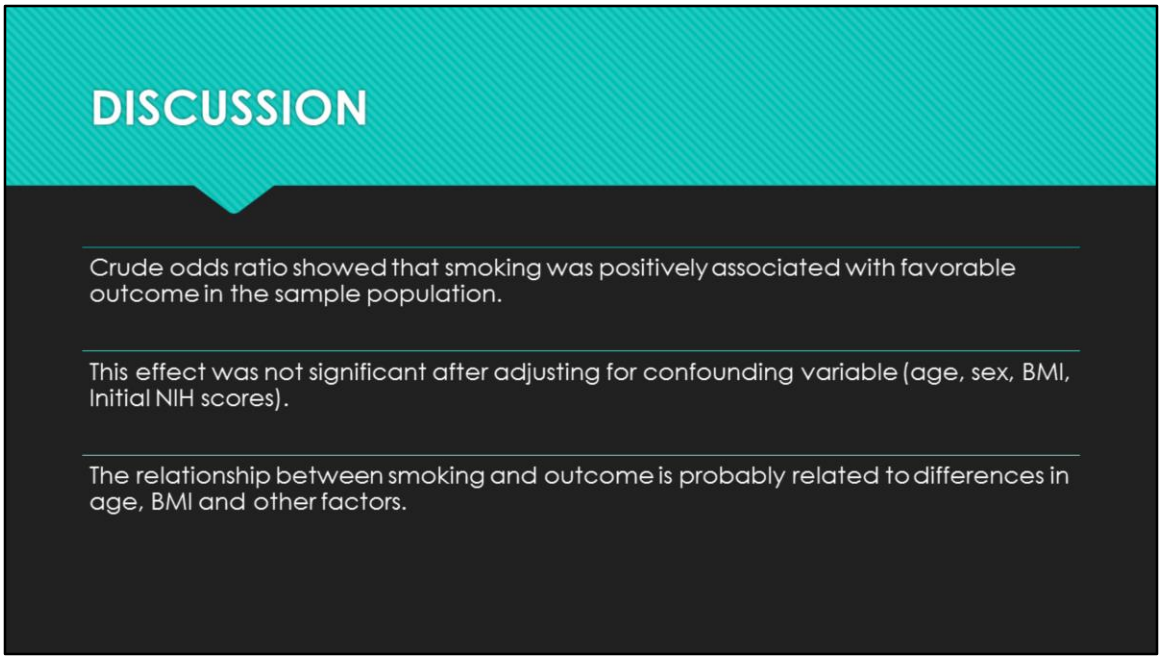

ROC Curve for Model
Area Under the Curve = 0.7218
Sensitivity
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
1 - Specificity

Table3. Multiple Logistic regression analysis with mRS 0–1 or 2–6 as dependent variable among stroke patients treated without tPA

AUC =73.34	Adjusted Odds Ratio	95% CI	p
Smoking	0.956	0.655- 1.395	0.8164
Age	0.966	0.955- 0.978	<.0001
Sex	0.723	0.535- 0.977	0.0349
NIH scale	0.906	0.884- 0.928	<.0001
BMI	1.017	0.995- 1.039	0.1403


ROC Curve for Model
Area Under the Curve = 0.7334
Sensitivity
1.00
0.75
0.50
0.25
0.00
0.00
0.25
0.50
0.75
1.00
1 - Specificity



Of 1,446 patients, 595 (41.15 %) were treated with TPA (181 smokers (47.76 %), 414 non-smokers (52.24 %) and 851 (58.85%) not treated with TPA (198 smokers (38.8 %), 653 non-smokers (61.2 %). In the multivariable models, smoking was not independently associated with favorable outcome in patients treated with TPA (OR = 0.84; 95% CI = 0.54 – 1.33; P-value = 0.46) and those not treated with TPA (OR = 0.96; 95% CI = 0.64 – 1.44; P-value = 0.85) though the bivariate models showed significant association.

Conclusion

There is no association between smoking and functional outcome in stroke patients regardless of TPA treatment. The effect of smoking on outcome in acute ischemic stroke patients treated with tissue plasminogen activator (TPA) is however stronger than those not treated with TPA.

DISCUSSION

- The effect of smoking on outcome in acute ischemic stroke patients treated with tissue plasminogen activator (TPA) is however stronger than those not treated with TPA with a negative non-significant association.

CONCLUSION

- Our study did not show significant association between smoking and favorable outcome in stroke patients treated with tPA.

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