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The University of Toledo

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Dedication

This project is dedicated to my girls, Becky and Baela. Although life is not guaranteed, I hope

the research and the time spent on this topic can make a difference in many lives, especially our

own, so you never have to go through life without your husband and daddy.

Acknowledgements

I would like to thank Dr. Gretchen Tietjen, MD for agreeing to be my major scholarly project advisor. Your expertise, help and guidance with this project is greatly appreciated. I sincerely thank you for making time for me and this research during your already very busy schedule.

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Introduction

Stroke is the fourth leading cause of mortality and the major cause of long-term disability in the developed world (Hall, Levant, & DeFrances, 2012; Lackland et al., 2014; Mozaffarian et al., 2015). The incidence of stroke in the aged is decreasing; a phenomenon attributed to improved control of traditional cardiovascular risk factors such as hypertension, hyperlipidemia, and tobacco (Mozaffarian et al.). Of concern is the finding that the incidence of stroke in young adults, particularly males, is increasing (Nedeltchev et al., 2005; Putaala et al., 2009). Earlier studies have noted that the proportion of unusual causes of stroke were particularly elevated in younger persons with stroke, but recent studies have noted that nearly all young persons with stroke have at least one traditional cardiovascular risk factor for stroke (Goeggel Simonetti et al., 2015; Hall et al.; Putaala et al.). Northwest Ohio has high prevalence of obesity and smoking, two risk factors for vascular disease. (Lackland et al., 2014) At the University of Toledo Medical Center (UTMC) approximately 10% of the acute strokes are 45 years of age and younger. Because of the impact of stroke on the individual's ability to function independently as well as on the socioeconomic consequences of disability at a young age, understanding the risk of primary and secondary stroke in the population may lead to improved preventive strategies (Goeggel Simonetti et al.; Nedeltchev et al.; Smajlovic, 2015).

Review of Literature

Increasing Prevalence of Stroke in the Young

The increase prevalence of stroke in the young has recently sparked interest in several studies investigating why stroke rates are continually on the rise in this population. Evidence supports the increased occurrence for stroke in people 45 years and younger. Data on stroke in the young can be found in many studies completed over the past 30 years. From 1983 to 1985 the average annual incidence of first stroke was 8.8/100,000 for both male and female ages 15-44 (Nencini et al., 1988). According to Naess, Nyland, Thomassen, Aarseth, & Myhr (2004), the study shows from 1988 to 1997 the average occurrence to be 11.4/100,000 overall. Most recently, according to Putaala et al. (2009), based on a study conducted between the years 1994 to 2007 the average annual occurrence rates overall were 10.8/100,000 with a range of 8.4 to 13.0 each year.

Statistics from another study showed increases of stroke in people age 20 to 44 (Kissela et al., 2012). In 1993/1994, this age group made up 4.1% of the stroke population; in 1999, the same age group was 4.6% of the population. Finally, 20 to 44 year olds accounted for 6.4% of the stroke population in 2005. According to Kissela et al., over this time period, increases were seen in both black and white populations.

Healthcare Issue for Stroke in the Young

The socioeconomic impact of stroke in the young is significant, particularly due to the fact that many stroke patients become disabled and forego their working years and are dependent on long-term nursing and social care. (Goeggel Simonetti et al., 2015) Stroke is a leading cause of disability, which will impact the economy by leaving victims disabled during their most

productive years. This is becoming a major public health problem since the incidence of stroke in the young is increasing, and therefore creating a necessity for additional understanding of this phenomenon in order to devise strategies to lessen this burden. (Smajlovic, 2015)

Not only do young stroke patients put burden on an already strained healthcare system, they often are unable to work and make an income throughout their lifetime. Furthermore, "the majority of survivors have emotional, social, or physical sequelae that impair their quality of life. In addition, young stroke victims may have been responsible for providing child care or generating income for their families. Therefore, the ability to predict prognosis would be of paramount importance in the patient population" (Nedeltchev et al., 2005).

According to Nedeltchev et al. (2005) the clinical outcome is typically categorized as favorable or unfavorable. A favorable outcome is described as having no symptoms at all or no major disability in spite of having symptoms. Favorable outcomes were found in 68% of young stroke patients. According to Goeggel Simonetti et al. (2015) research on outcomes of stroke in the young has shown lingering physical and psychosocial damage in at least a third of patients, meaning 67% have a more favorable outcome. Another study described that 87% had favorable outcomes (Leys, 2003). In contrast, one older study found that only 57% of stroke patients under the age of 45 years had a favorable outcome, Neau et al. (1998) and another stated that only 11% reporting a favorable outcome (Rozenthul-Sorokin, Ronen, Tamir, Geva, & Eldar, 1996).

Stroke Risk Factors Defined

Risk factors can be placed into three main categories; behaviors, conditions, and vascular diseases. Behaviors such as smoking tobacco, and drug and/or alcohol abuse contribute to stroke risk. The conditions that comprise stroke risk factors include hypertension, dyslipidemia, obesity,

diabetes mellitus, atrial fibrillation, heart failure, prosthetic heart valve, renal insufficiency, family history of stroke, personal history of stroke or transient ischemic attack (TIA), depression and migraine. Vascular diseases that are common in stroke patients include coronary artery disease, carotid stenosis and peripheral vascular disease.

A recent study of stroke risk factors defined family history of stroke as stroke occurring in first degree relatives (Goeggel Simonetti et al., 2015). Personal history of previous stroke was defined as radiological signs on brain imaging with or without clinical signs or symptoms. Previous TIA was defined as a neurological deficit lasting less than 24 hours. Depression and migraine were not further defined. However, in another risk factor study, depression was defined as feeling sad, blue, down, or depressed for two or more consecutive weeks in the previous 12 months prior to the stroke (O'Donnell et al., 2010). Patient behaviors that contribute to stroke concentrated on current smoking, or the cessation of smoking in the 10 years prior to stroke, but drug and alcohol abuse were not discussed. Furthermore, several health conditions or diseases such as hypertension, were classified as a modifiable vascular risk factor. Hypertension was defined by preadmission history or use of antihypertensive medication. Dyslipidemia or hypercholesterolemia is defined as total venous plasma cholesterol greater than 5 mmol/l or the patient was taking cholesterol-lowering medications. Increased body weight is also an established risk factor for stroke, the correlation of body size and obesity can be defined as Body Mass Index (BMI) of 30kg/m² or higher (Lackland et al., 2014). Traditionally diabetes mellitus is determined clinically as glycosylated hemoglobin A1C of 6.5% or higher, fasting plasma glucose (FPG) value of 126 mg/dl or higher or an oral glucose tolerance test (OGTT) of 200mg/dl or higher (Karsito & Soeatmadji, 2008). Goeggel Simonetti et al. (2015) defined diabetes as two fasting venous plasma glucose values of greater than or equal to 7 mmol/l or currently using

antidiabetic medication. Medical conditions such as atrial fibrillation (diagnosed on ECG), heart failure, prosthetic heart valve and renal insufficiency are determined by diagnosis by a medical professional as set in standard of care recommendations.

Stroke Risk Factors: Old vs. Young

It is well documented that hypertension is a major cause of mortality and morbidity, and is also one of the top cardiovascular disease risk factors, leading to stroke in all age groups (Tancredi & Martinelli Boneschi, 2012). While hypertension is the leading risk factor for stroke in older adults, evidence indicates it may not be the leading cause of stroke in the young. Data suggest risk factors for stroke are the same when comparing the two age groups, but the risk factor prevalence differs (Smajlovic, 2015). According to Putaala et al. (2009), while it is apparent that young stroke patients have traditional vascular risk factors just as do the older adults, there are also risk factors unique to younger adults. These risk factors include history of migraine, particularly migraine with aura, and the use of combined oral contraceptives (Tancredi et al., 2013).

Several studies agree with Smajlovic (2015) that risk factors for stroke are the same in all age groups, with varying prevalence. The rank order of prevalence of the most common stroke risk factors in young adults (i.e. smoking, obesity, hyperlipidemia, hypertension, and for women combined oral contraceptive use) also vary between studies. According to Goeggel Simonetti et al. (2015) the risk factors most common to the young are hypercholesterolemia, smoking, and hypertension. Specifically in women, 19% of all female patients were taking oral contraceptives. Another study found that the most common risk factors in the young were hypertension, smoking, and obesity (Kissela et al., 2012). Furthermore, Kissela et al. demonstrated, using

2005/2006 NHANES data, that obesity was the leading risk factor followed by current smoking, high cholesterol and hypertension. According to the study by Nedeltchev et al. (2005) smoking was the most common risk factor in stroke in the young, followed by hypercholesterolemia, and C-reactive protein levels greater than 5mg/l. Among the women in this study, 22% used oral contraceptives. In the data analyzed by Putaala et al. (2009), the most common risk factors in the young were dyslipidemia, followed by smoking, hypertension and obesity. Oral contraceptive use was the most common risk factor in women younger than 30 years old. According to Smajlovic, the most common risk factors in the young are dyslipidemia, smoking, and hypertension. The most common risk factors in the old are hypertension, heart disease (including atrial fibrillation) and diabetes mellitus. Finally, the study from Tancredi et al. (2013) reports the number one risk factor for stroke in the young is smoking, then hypertension, hypercholesterolemia, and obesity. Oral contraceptives played a major role in this study's population with 42% of the women using them.

Modifiable Risk Factors

Modifiable risk factors are those that can be changed, altered, or controlled through use of proper medications. Modifiable risk factors include smoking, obesity, hypertension, hyperlipidemia, diabetes mellitus, depression, drug and alcohol abuse, atrial fibrillation, heart failure, coronary artery disease, carotid stenosis, heart failure, peripheral vascular disease, renal insufficiency, prosthetic heart valve, and migraine. A common theme among young stroke patients is the high number of risk factors they have at the time of stroke. According to Putaala et al. (2009) and Smajlovic (2015), the modifiable risk factors are surprisingly high in the young. Understanding the risk factors for stroke that are modifiable can make an impact on preventing

stroke in the young. One study estimates 96% of young stroke patients had at least one vascular

risk factor. In that same study, 73% of stroke patients were found to have modifiable risk factors

(Goeggel Simonetti et al., 2015). Another study found similar results, about 95% of young adults

with stroke had at least one risk factor (Putaala et al.). A study conducted by Tancredi et al.

(2013) revealed that 71.5% of young stroke patients had at least one or more risk factors.

Specifically, the study showed 33.3% had exactly one risk factor, 22.8% had two risk factors and

15.4% had three or more risk factors. The study discovered 28.5% had no risk factors.

The Present Study

More research is needed in specific population to target risk factors or combination of

risk factors, which are most prevalent in young persons with stroke (Goeggel Simonetti et al.,

2015; Nedeltchev et al., 2005; Smajlovic, 2015). Because stroke in the young causes personal

disability as well as the great consequences of socioeconomic impact, it is important to

determine the risk factors and the prevalence of risk factors for stroke (ischemic and

hemorrhagic) and transient ischemic attacks in persons 45 years of age and younger so that

preventative measures can be improved for this population and reduce the burden of stroke in the

young.

Purpose

Northwest Ohio has high prevalence of obesity and smoking, two risk factors for vascular

disease. (Lackland et al., 2014) For the purpose of this retrospective research study, we analyzed

data from the UTMC Get with the Guidelines (GWTG) registry with regards to the behaviors

(e.g. smoking, drug/alcohol abuse), conditions (e.g. hypertension, dyslipidemia, obesity,

migraine), and vascular diseases (e.g. peripheral vascular disease, coronary artery disease), which comprise stroke risk factors (George, Tong, Kuklina, & Labarthe, 2011; Maaijwee, Rutten-Jacobs, Schaapsmeerders, van Dijk, & de Leeuw, 2014. We determined the prevalence of individual and combinations of risk factors. Our findings were compared to data from persons of similar age and gender participating in the National Health and Nutrition Examination Survey (NHANES) for the year 2013-2014.

Methods

Procedure

The study is a retrospective analysis of data which includes stroke risk factors in young adults presenting to UTMC with acute stroke and entered into the UTMC "Get with the Guidelines" stroke registry between January 1, 2003 and December 31, 2015. Permission for this research was approved by the University of Toledo Institutional Review Board (see Appendix). Inclusion criteria included: 1) entered into the GWTG stroke registry, 2) ages 18-45 years old, and 3) hemorrhagic stroke, ischemic stroke or transient ischemic attack. There were no specific exclusion criteria. There were a total of 247 total records of patients age 18-45 during this time period. Factors analyzed were 1) based on history: demographic data (age, gender, race), family history of stroke, smoking history, hypertension, heart failure, dyslipidemia, migraine, estrogen therapy, current pregnancy, diabetes mellitus, prior stroke, prior TIA, carotid stenosis, renal insufficiency, sickle cell, obesity/overweight, sleep apnea, depression, prosthetic heart valve, coronary artery disease, congenital heart defects, known atrial fibrillation/flutter, and peripheral artery disease; 2) based on in-hospital assessment: current body mass index (BMI), blood pressure, glycosylated hemoglobin, fasting lipid profile, atrial fibrillation on telemetry, and EKG abnormalities; and 3) presumed etiology based on history and assessment. This included the diagnosis and primary mechanism of stroke. Data was also collected from the patient's medical record using UTMC's patient clinical portal. The variables collected from the medical record include: 1) presence/absence of patent foramen ovale (PFO); 2) presence/absence of hypercoagulable abnormality; presence/absence of remote strokes on neuroimaging. This information was not available from GWTG registry and therefore medical records were accessed in order to have a comprehensive data study to determine the frequency of the risk factors that

are common among younger populations. No actual patient imaging (e.g. CAT scan, MRI) were

viewed or collected; the data was abstracted from the reports. No data was accessed or collected

past the December 31, 2015 date. We used coded data, and maintained a key that contains a

medical record number that corresponds to a unique ID code for the variables collected from

GWTG registry as well as the patient's medical record. There was no patient identity information

recorded, saved or printed at any time in the Excel spreadsheet that we used as the data collection

tool to collect the pertinent data from the GWTG registry and medical records. The GWTG

registry and medical record was only accessed on a secure, password-protected computer. The

key and data was stored in different binders inside a locked filing cabinet at Ruppert Health

Center 1613, and was destroyed using university approved document shredding bins located on

campus. PHI will be kept for 6 years.

Data Analysis

The statistical analyses were performed using SPSS and SAS statistical software. First we

analyzed the data from the research using descriptive statistics, such as standard deviations on

the continuous data, and means for the categorical data. Secondly, for the NHANES data we

used a one sample t-test for continuous variables, and a test of single proportion for categorical

variables. To compare the proposed study with national data abstracted from NHANES we used

a chi-squared test for comparing portions.

Results

Of the 247 patient records available in the database, 14 different patients (5.66%) had one or more recurrent episodes of stroke or TIA and were re-entered into the database under the same patient ID number (n = 229). Of the 14 patients with recurrent stroke or TIA, there were 7 males, (5 white and 2 black) and 7 females (6 white and 1 black).

Demographic Data

We divided the patients in the study into four age groups, 18-24 (n=17, 7.4%), 25-31 (n=23, 10.0%), 32-38 (n=67, 29.2%), and 39-45 (n=122, 53.2%) years old (Figure 1). The mean age of stroke was 37.52 years, with a standard deviation of 6.686.
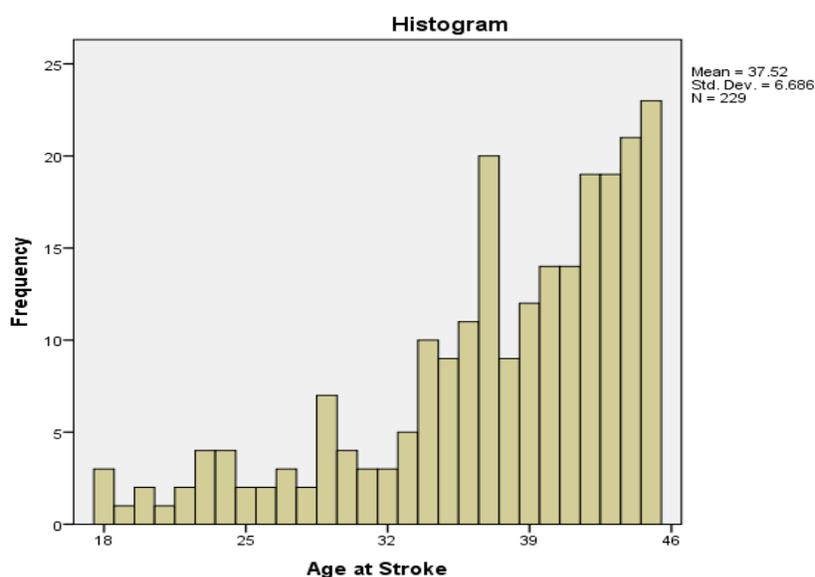

Figure 1. Age of the patient at the time of stroke.

The majority of the patients in the study were males. There were 121 males (52.8%) compared to 108 females (47.2%) in the study sample (Figure 2).

Gender

	Frequency	Percent	Cumulative Percent
Female	108	47.2	47.2
Male	121	52.8	100.0
Total	229	100.0	

Figure 2. Distribution of gender

Females made up the majority of the younger age groups, and males made up the majority of the oldest age group (Figure 3). There were 13 females in the age group 25-31 (12% of female population), compared to 10 males in the same age group (8% of the male population). There were 68 males in the 39-45 age group (56% of male population), compared to 54 females in the same group (50% of female population).
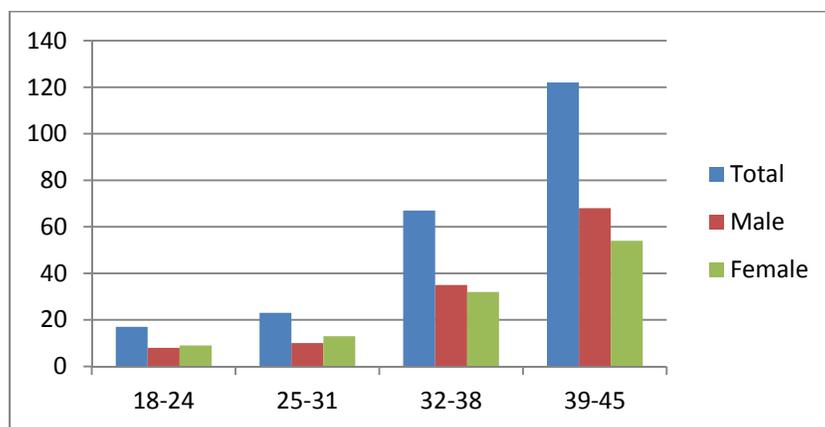

Figure 3. Comparing Age Group to Gender

White patients were the overwhelming majority race for stroke in the young (65%) (Figure 4). Black or African Americans made up roughly 29% of the population. There are 12 patients who identified themselves as Hispanic which comprised of 5% of the population. There

was 1 patient who identified with the Asian race (0.5%), and 1 patient we were unable to determine the race (0.5%).
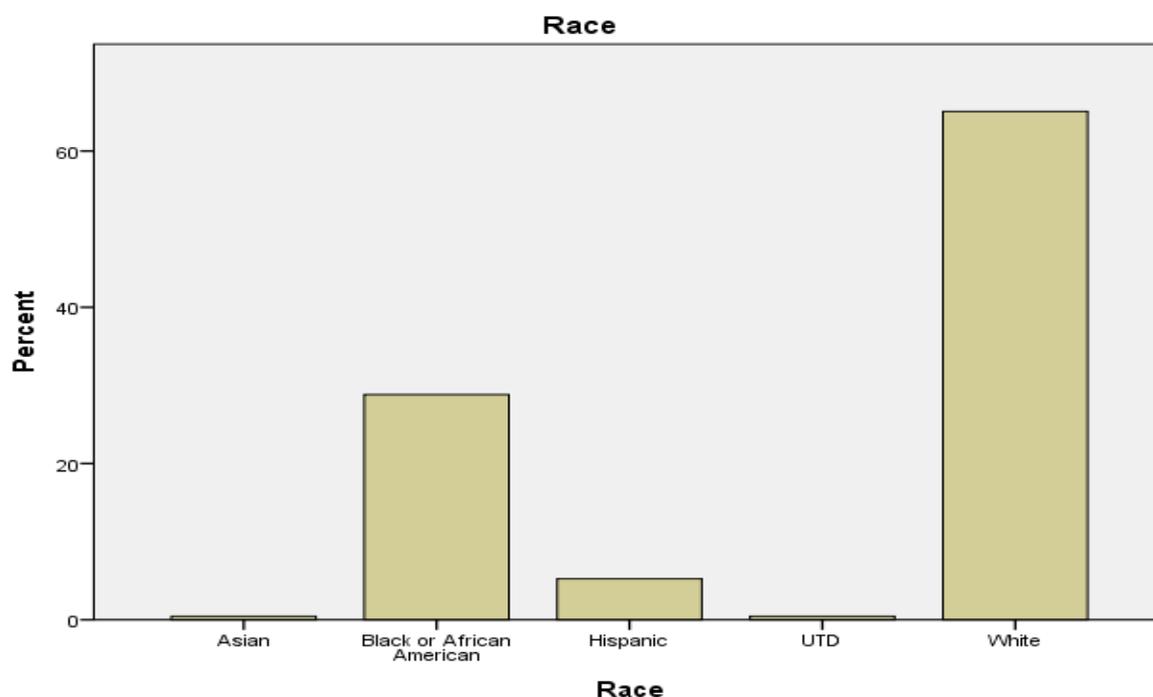

Figure 4. Percentage of stroke patients by Race

Type of Stroke

The most common type of stroke in the young was ischemic stroke (54.6%). There were 125 ischemic strokes, which accounted for over half of the strokes recorded in this study (Figure 5). Transient ischemic attacks (TIAs) occurred 61 times (26.6%), which are classified as symptoms of stroke less than 24 hours. There were 43 hemorrhagic strokes (18.8%) that were comprised of 19 subarachnoid hemorrhages (8.3%) and 24 cerebral hemorrhages (10.5%).
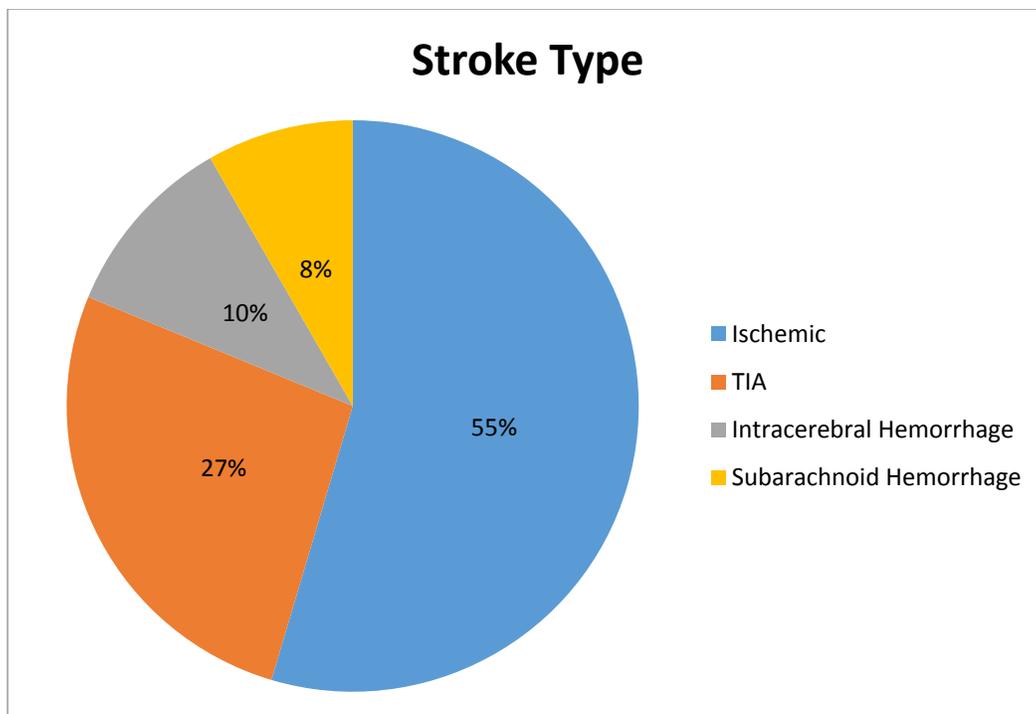
Figure 5. Type of Stroke

Risk Factors

There were 44 patients in this study that had no defined risk factors for stroke (19.2%), while 185 patients had at least 1 or more risk factors (80.8%) (Figure 6). 55 patients had 1 risk factor alone (24.0%), 49 patients had 2 risk factors (21.4%), 39 patients had 3 risk factors (17.0%), and 42 patients had 4 or more risk factors (18.3%).

	Frequency	Percent	Cumulative Percent
0	44	19.2	19.2
1	55	24.0	43.2
2	49	21.4	64.6
3	39	17.0	81.7
4	42	18.3	100.0
Total	229	100.0	

Figure 6. Number of risk factors

The most common risk factors were hypertension (HTN) (51.5%), smoking (41.0%), obesity/overweight (24.5%), dyslipidemia (21.0%), diabetes mellitus (DM) (20.1%), history of previous stroke/TIA (12.2%) and CAD/Prior MI made up 4.4% (Figure 7). Patients having no risk factors make up 19.2%. Patent foramen ovale (PFO) contributed to only 7.0% of the population.
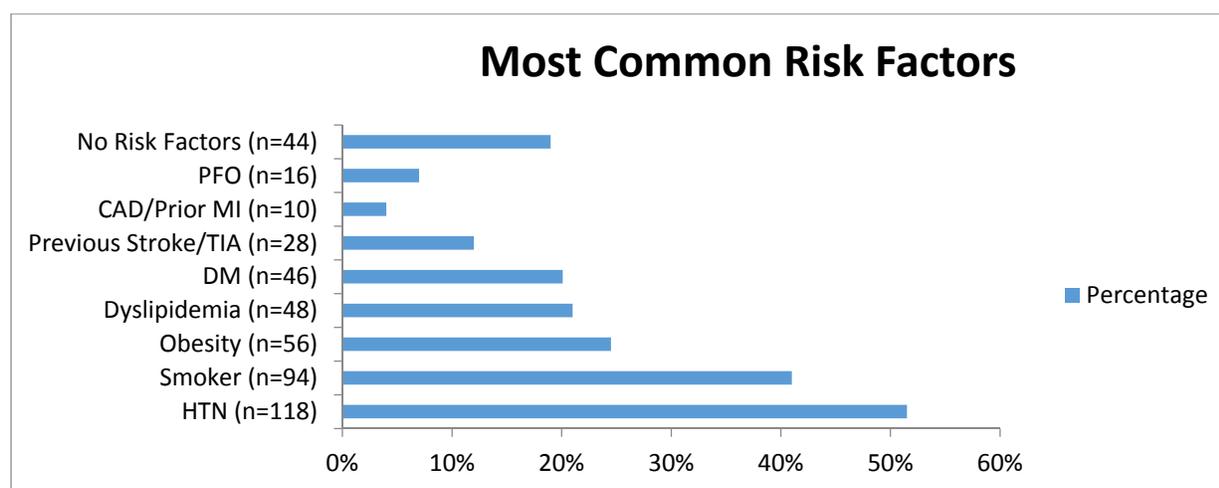

Figure 7. Most Common Risk Factors

Combinations of risk factors were analyzed for this study. Having no risk factors occurred the most often at 44 times (19.2%). Smoking alone, which occurred 23 times (12.4%) was the most common, followed by hypertension alone, which occurred 18 times (9.7%), and then hypertension and smoking together occurred 16 times (8.6%). There were 6 patients (3.2%) that had the combination of hypertension, obesity, and smoking. A list of all the various combinations can be found in Figure 8.
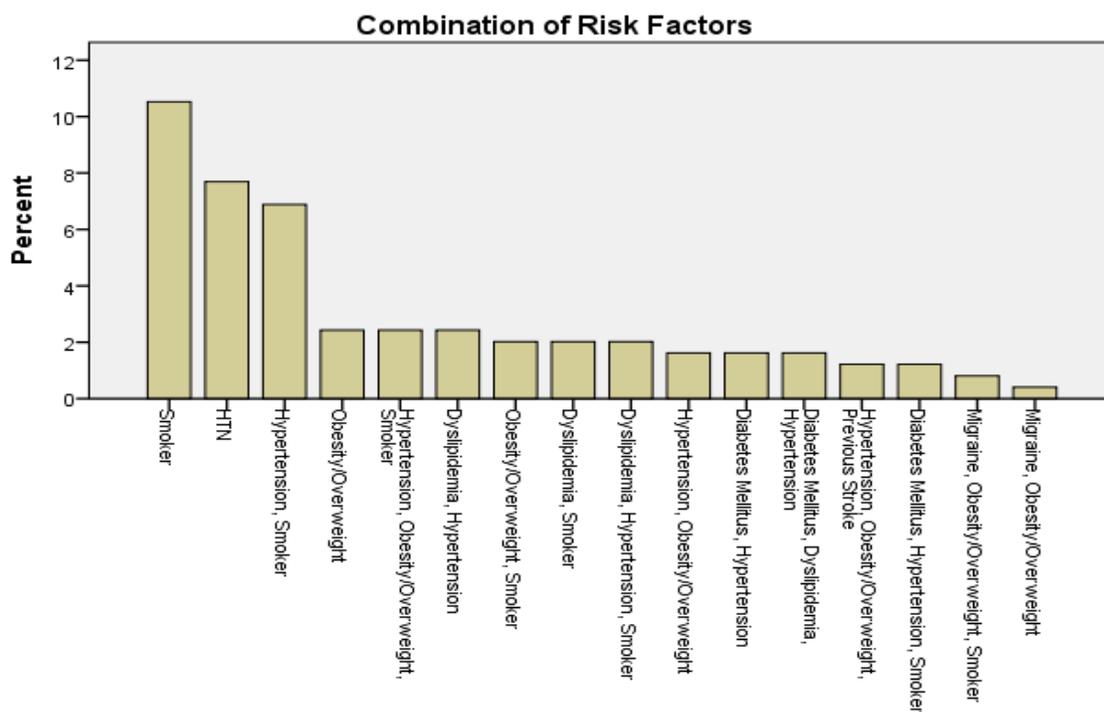
Migraine related risk factors were added to chart, all other risk factors that occured less than 1% have been excluded.

Figure 8. Combination of Risk Factors

Patent Foramen Ovale

A patent foramen ovale (PFO) was found in a total of 16 patients (7.0%). PFO and obesity occurred 6 times (2.6%) and similarly PFO and smoking also occurred 6 times (2.6%). PFO and hypertension happened 5 times (2.2%). PFO with no other risk factors happened 5 times (2.2%) (Figure 9).
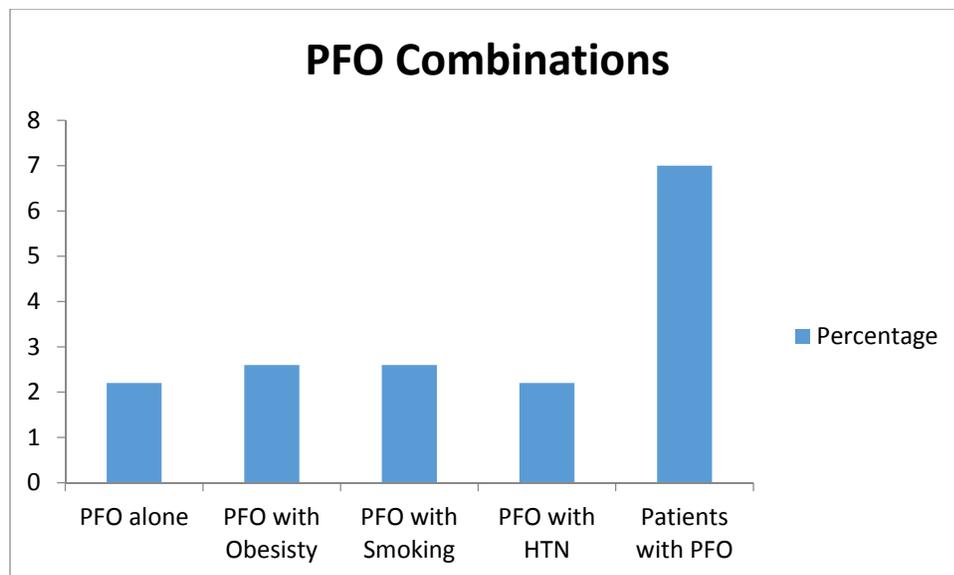

Figure 9. Patent Foramen Ovale Combinations

NHANES Data

NHANES data collected shows a total of 42 strokes for population 45 years old and younger. Sum of weights analysis was performed and statistical data was adjusted accordingly in the data to follow. Demographics for this survey revealed 25% males and 75% females. There are 56% Whites, 24.5% Hispanics, 15.5% Black, 1.5% Asian, and 2.5% that did not identify with a race. Risk factors were also analyzed (Figure 10) and determined 15.3% were current smokers, 93.3% have hypertension, 22.1% have dyslipidemia, 46.5% have diabetes mellitus, 51% were overweight/obese, 30.2% had CAD/MI, and 23% had no risk factors.
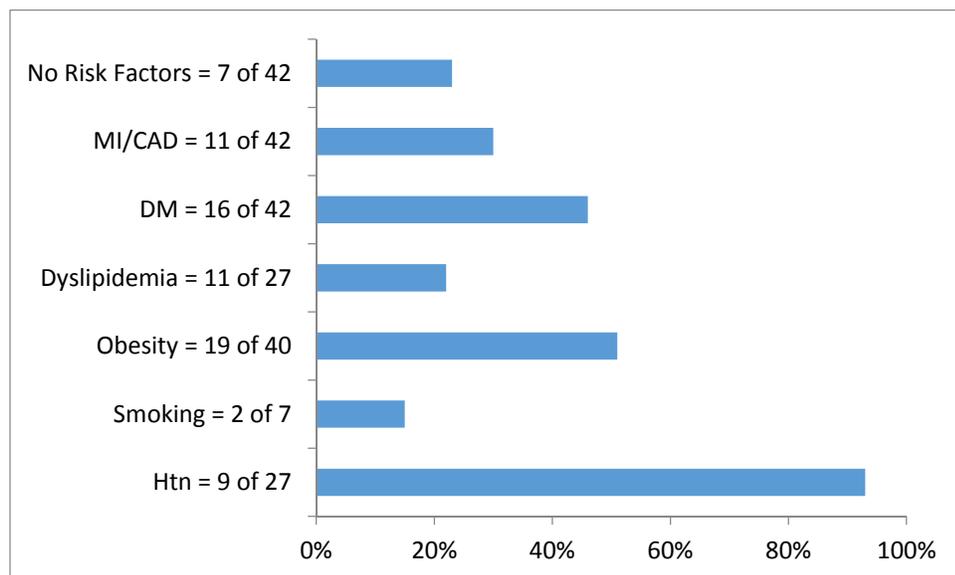
Figure 10. NHANES data - risk factors

Discussion

Results from this study revealed that 185 patients, which is 81% of the population had at least 1 or more risk factors for stroke. Surprisingly a high number of patients, 44, had no identifiable risk factors (19% of population) despite having had a comprehensive work up. The most prevalent risk factors were all modifiable, such as hypertension, smoking and obesity occurring for 52%, 41%, and 25% of the time respectively. Males have a higher overall rate of stroke (53% of the population study). However, females were found to have more strokes in the younger age groups (age 18-31) compared to males. White patients are the most common race in the younger stroke population. The number of young Hispanic males with stroke was 5 times more than the number of Hispanic females. Ischemic stroke was the predominant stroke type (55%) in the young stroke patients enrolled in the UTMC GWTG database.

The high percentage of patients with modifiable risk factors (81%) strongly supports published data demonstrating one or more conventional stroke risk factors in a similar proportion of the population (72% to 95%) at the time of stroke. This study revealed hypertension, smoking and obesity as the top 3 risk factors in descending order of frequency, mirroring the study conducted by Kissela et al. (2012). Other studies show the same risk factors but in different proportions, such as the study from Tancredi et al. (2013) and Nedeltchev et al. (2005) which both demonstrate that smoking is the most prevalent risk factor. Other studies show dyslipidemia or hypercholesterolemia as the most common risk factor (Goeggel Simonetti et al., 2015; Putaala et al., 2009; Smajlovic, 2015).

Other notable risk factors from the present study include dyslipidemia (21%), diabetes mellitus (20%), history of previous stroke/TIA (12%), and PFO (7%). No other risk factor occurred more than 5% of the time. This information is in direct conflict with some earlier

studies that suggest increased cases of unusual causes of stroke in the young. The data from this study correlates with more recent research in that risk factors for stroke are the same in all age groups, but it is the prevalence of these risk factors that occur at different rates (Smajlovic, 2015).

The data in women with regards to the use of oral contraceptives is more consistent. Typically, oral contraceptive use is the most common risk factor in women less than 30 years old. Prevalence of the use of oral contraceptives among young women with stroke range from as low as 19% and as high as 42%. The current study reflects a high percentage of women (n=7, 41%) under 30 years old using oral contraceptives at the time of stroke (Figure 11).
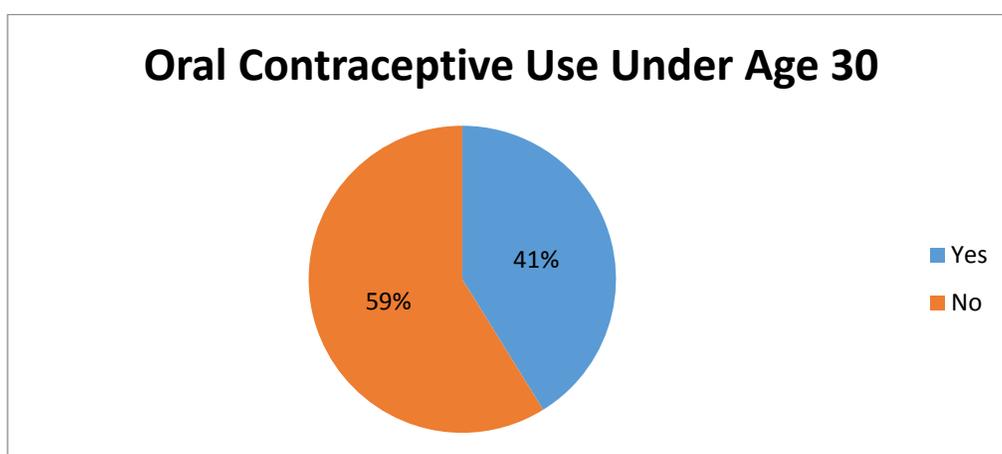
Figure 11. Oral Contraceptive Use in Women under Age 30 Years Old

PFO in the general population are estimated to be 25%. The current study revealed that 7% of its population was found to have PFO on imaging studies performed post stroke such as TEE and TTE. PFO was found in at least 16 patients, and typically found in patients with at least 1 other risk factor, most commonly hypertension, smoking, and obesity. There were 5 patients who didn't have any known risk factors, however, follow up imaging showed PFO in these patients.

When the present study was compared to the NHANES data, the same risk factors were prevalent, but occurred at slightly different rates, as indicated earlier in this discussion and correspond with the study by Smajlovic (2015). The most common risk factors for young people with stroke, according to the NHANES data, were hypertension (93%), overweight/obesity (51%), diabetes mellitus (46%), and dyslipidemia (22%) respectively.

Strengths of Study

The major strength of this study is the comprehensive analysis of current and past literature, a regional retrospective study, and comparing it to a national survey, NHANES data.

Limitations of Study

Definitions of young age in years, in studies of stroke in the young, are inconsistent between studies. There were varying cutoff points for age in studies previously conducted (i.e. age 50 and younger, or age 44 and younger). The present study used the population of 18-45 year olds.

Conclusion

The present study revealed 81% of young stroke patients in Northwest Ohio have at least one or more risk factors for stroke. Young stroke patients are most likely to be male, and suffer from ischemic stroke. The mean age at the time of stroke was 37.5 years old and the median age was 31.5 years old. Hypertension, overweight/obesity, smoking, dyslipidemia, and diabetes mellitus are the most prevalent risk factors in the young stroke population. Medical management and early detection of these conditions may have an impact of reducing first and recurrent strokes in the young.

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Appendix

The University of Toledo
Department for Human Research Protections
Biomedical Institutional Review Board
Center for Creative Education Building   Room 0106
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Phone: 419-383-6796   Fax: 419-383-3248
(FWA00010686)

TO: **Gretchen Tietjen, M.D.**
           UT Department of Neurology

FROM: Roland Skeel, M.D., Chair
           Boyd Koffman, M.D., Ph.D., Vice Chair
           Susan Pocotte, Ph.D., Vice Chair
           Steven Peseckis, Ph.D., Vice Chair
           Rachel Karus, PharmD, Chair Designee
           UT Biomedical Institutional Review Board

SIGNED: _Rachel Karus_ DATE **25 MAY 2016**

SUBJECT: **IRB # 201220**
           Protocol Title: Risk factors: A study of stroke in the young

The above project was reviewed and approved by the Chair and Chair Designee of the University of Toledo Institutional Review Board as an **expedited review** (category #5).   The requirement to obtain a informed consent/authorization for use and disclosure of protected health information form has been waived as this research is determined to be minimal risk, will not adversely affect the rights and welfare of subject and the research cannot be carried out without the waiver. This research is **approved** for a period of up to one year from the date of this review and approval. This action will be reported to the committee at its meeting on 06/16/16.

Items Available for Review:
- IRB Application Requesting Initial Expedited Review of Research
  - Methods and Procedures Overflow document dated 5/25/16
- Protocol dated 05/25/2016
- Data Collection Tool version date 05/11/2016
- Key Code version date 05/16/2016
- Request for Waiver of Individual Authorization For Use and Disclosure of Protected Health Information (PHI) for Purposes of Research version date 05/11/2016

This research is approved until the expiration date listed below, unless the IRB notifies you otherwise.

You are approved to review up to 2<u>50</u> records.

| APPROVAL DATE: 05/25/2016 | EXPIRATION DATE: 05/24/2017 |

Please read the following attachment detailing Principal Investigator responsibilities.

Abstract

Objective: To analyze risk factors most prevalent in young patients presenting with acute stroke in Northwest Ohio. **Method:** We analyzed all 247 stroke patients aged 18-45 presenting to the University of Toledo Medical Center using recorded data entered into the Get with the Guidelines stroke registry between 2003 and 2015. Factors were based on medical history and in-hospital assessments. **Results:** 81% of stroke patients had at least one or more risk factors present at the time of stroke. Hypertension (52%), smoking (41%), and overweight/obesity (25%) are the most common. Males suffer from stroke more often (53%). However, females have more strokes under the age of 30, in which 41% used oral contraceptives. Ischemic stroke and TIA occurred 82% of the time. **Conclusion:** Risk factors for stroke are the same in all age groups, but it is the prevalence of these risk factors that occur at different rates.