Acta Neurochirurgica (2019) 161:2381–2387
https://doi.org/10.1007/s00701-019-04036-7

ORIGINAL ARTICLE - VASCULAR NEUROSURGERY - ANEURYSM

Spontaneous subarachnoid haemorrhage incidence among hospitalised patients in Edirne, Turkey

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Received: 12 February 2019 / Accepted: 9 August 2019 / Published online: 7 September 2019

Abstract

Background To the best of our knowledge, no data has been published about the spontaneous subarachnoid haemorrhage (sSAH) incidence in Turkey. We aimed to report the estimation of sSAH incidence in Edirne Province, in Turkey for the first time, using the data acquired from a single medical centre which has the biggest and the most comprehensive emergency department in Edirne and to where a great majority of patients are referred.

Methods We investigated all the accessible sSAH patients' data obtained from computer-based automation systems and all the written documents in the neurosurgery and the emergency departments. Patients included in the study were diagnosed with sSAH between the dates of January 2007 and December 2011 and were resident in Edirne. We used this data to calculate the crude and age-adjusted incidence rates of sSAH for every decade.

Results One hundred fifty-four patients have been diagnosed with sSAH during a 5-year period. Among them, 72 were men (47.8%) and 82 (53.2%) were women. The mean age of the patients was 60.8 years and age range was 23–85 years. The overall annual adjusted incidence rate for sSAH was 10.3 per 100,000 person-years (95% confidence interval = 10.2–10.3). Annual adjusted incidence rate was 10 per 100,000 person-years (95% confidence interval = 10–10.1) for men. For women, it was 10.4 per 100,000 person-years (95% confidence interval = 10.4–10.5). For both sexes, after the 6th decade, the annual incidence rate of sSAH was higher than 10 per 100,000, reaching over 20 per 100,000 person-years after the 7th decade. The overall crude incidence rate for sSAH was 10.3 per 100,000 person-years. For men, the crude incidence rate was 9.4 per 100,000 person-years and for women, it was 11.2 per 100,000 person-years.

Conclusions This study showing the first sSAH incidence estimation in Edirne might also be accepted as an estimation of overall epidemiological sSAH aspect in Turkey. Future investigations should be realised in different parts of Turkey to enlighten the epidemiological state of affairs and the course of sSAH in Turkey.

Keywords Incidence · Intracranial aneurysm · Subarachnoid haemorrhage · Turkey

Abbreviations

112 EHSS	112 Emergency Health Services System
GCS	Glasgow Coma Scale
GOS	Glasgow Outcome Scale
SAH	Subarachnoid haemorrhage
SII	Social Insurance Institution
sSAH	Spontaneous subarachnoid haemorrhage
SSI	Social Security Institution
TUIK	Turkish Statistical Institute
WFNS	World Federation of Neurosurgical Societies

The preliminary results of this manuscript have been presented as an oral presentation in the 15th World Congress of Neurosurgery on 8–13 September 2013 in Seoul, Republic of Korea.

This article is part of the Topical Collection on *Vascular Neurosurgery – Aneurysm*

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Introduction

Spontaneous subarachnoid haemorrhage (sSAH) is one of the most critical diseases for neurosurgical clinics due to its high rate of mortality and morbidity. Cerebral aneurysms which cause approximately 5% of all cerebrovascular strokes are

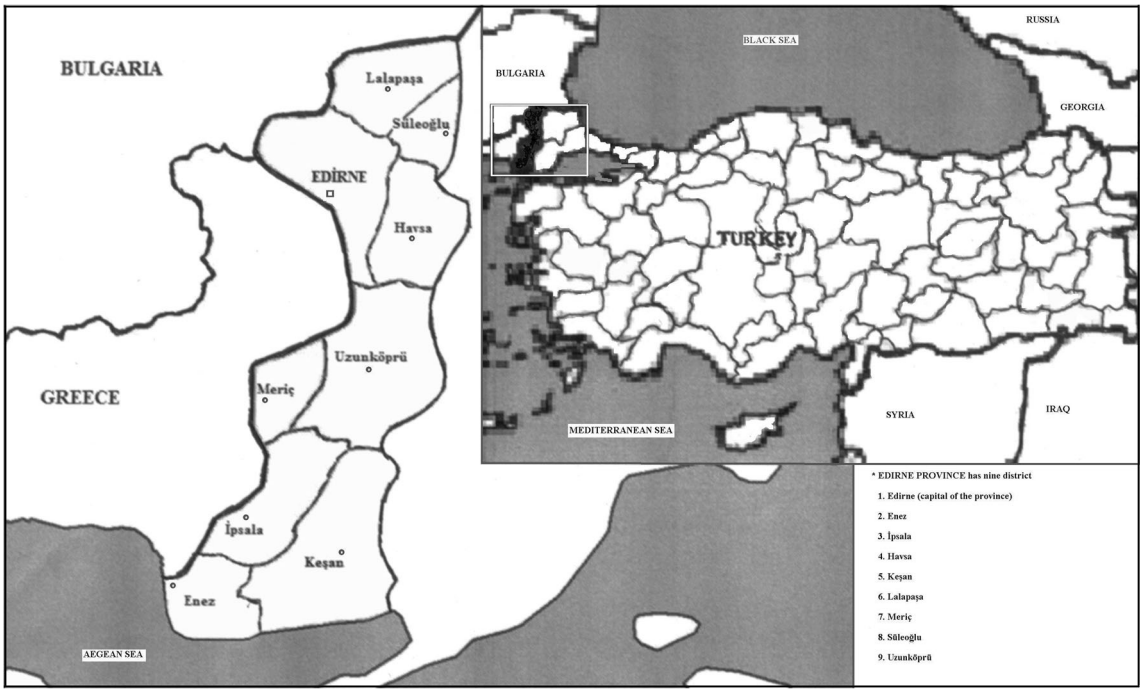

Fig. 1 Study location (Edirne)

also responsible for 85% of spontaneous subarachnoid haemorrhages with higher mortality and morbidity. While non-aneurysmal perimesencephalic haemorrhage consists of 10% of the sSAH cases (generally with excellent prognosis), a variety of other rare conditions constitutes the remaining 5% [13, 17]. A very large group of sSAH patients dies before reaching any medical aid. Korja et al. reported that approximately 20% of the sSAH patients die before reaching any hospital [10].

sSAH incidence differs in different regions around the world with a range between 2 and 32 cases per 100,000 person-years. This range depends on study methodology, consistency of the referral populations, genetic characteristics and risk factors [1–6, 9, 11, 12, 14–25]. Most of the population-based studies have been published from developed countries or low populated small countries.

To the best of our knowledge, there is a lack of population-based information published on the sSAH in Turkey. Likewise, we could find accurate data neither on patients who had died before reaching any hospital nor on those who had reached. The main reason for it is the difficulty of acquiring reliable data on a specific population. sSAH patients are generally referred to different clinics and these clinics cover overlapped areas. Turkey's health system was not well organised before 2006. More than five different organisations were managing the system and the health data was not well conserved [8]. In addition to this, no annual census data was available until 2007 [7].

While more than five different organisations were managing the health insurance system, three large organisations were providing the health care in Turkey before 2007: Social Insurance Institution (SII) Hospitals, State Hospitals and University Hospitals. Therefore, patients were first referred

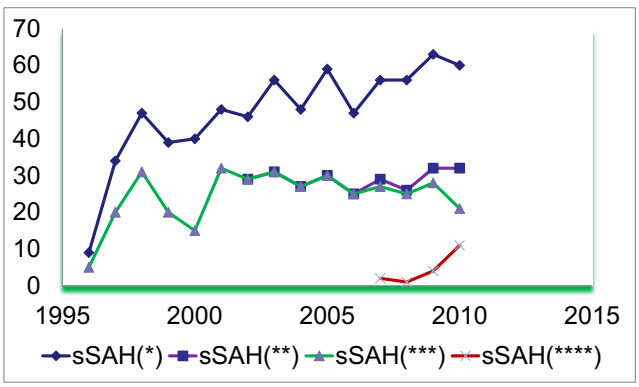

Fig. 2 Number of sSAH cases in Edirne over the years (1996–2011). sSAH(*) All sSAH patients. sSAH(**) Patients resident in Edirne. sSAH(***) Hospitalised patients resident in Edirne. sSAH(****) Transferred patients resident in Edirne. Between 2009 and 2011, the lack of suitable place in intensive care units forced us to transfer an increased number of patients to other medical centres

Table 1 Demographic parameters of sSAH patients

	n	%	Mean age	Min age	Max age
All patients	304	100	57.7	22	87
Female	154	51	58.6	24	83
Male	150	49	56.7	22	87
Transferred patients	35	100	69.6	49	83
Female	19	54	71.9	51	83
Male	16	46	66.9	49	83
Diagnosis via CT	35	100			
Hospitalised patients	269	100	56.1	22	87
Female	135	50	56.8	24	82
Male	134	50	55.4	22	87
Patients resident in Edirne	119	44			
Patients not resident in Edirne	150	56			

to the hospitals of the health care organisation they were involved in. Patients were treated as good as possible within their own systems. For this reason, patients with SII insurance were sent to the major SII hospitals in Istanbul and not to the closest institution. Although in 2006, the healthcare organisations merged under the name of 'Social Security Institution (SSI)'. The '112 Emergency Health Services System (112 EHSS)' was established and integrated with the SSI system. After this date, it has been started to refer the patients to the most appropriate health centre via the 112 EHSS.

Edirne is a small province located in the European part of Turkey which is named Thrace Region. It is a border province with Greece and Bulgaria (Fig. 1). Its census data is annually available since 2006. Its population is approximately 400,000 and was roughly stable during the study period.

We aimed to estimate the sSAH incidence in Edirne, Turkey, and to contribute to the global data while exploiting the advantages of the new unified health organisation named Republic of Turkey Social Security Institution and of the annual census data.

Methods

The Trakya University Medical Faculty Neurosurgery Department has started to treat sSAH patients by the end of the year 1996 and became the first and the only centre to refer sSAH cases no matter which health organisation the patient is involved in all Thrace Region except for Istanbul (Fig. 2). Digital subtraction angiography was available only in our institution along with the aneurysm clips' set used for surgical treatment of cerebral aneurysms. In that time, neither surgical nor endovascular treatment was available in any clinic, except for the Trakya University Hospital in Edirne. For the time interval of the study, our institution kept this advantage within three adjacent provinces: Çanakkale, Kırklareli and Tekirdağ. Ranging more than 200 km up to Istanbul, the Trakya University Hospital was the only centre having treatment facilities in Thrace Region.

Between the years of 2000 and 2011, 693 patients, and during the study period, from 2007 to 2011, 304 patients applied to our institution. Thirty-five of these 304 patients were directly referred to external centres because of the occupancy of the intensive care unit and they could not be admitted to our hospital. A total of 154 patients were diagnosed with sSAH in Edirne during that period. Excluding a minority of very high-grade sSAH patients treated with palliative treatment and symptomatic methods such as intubation, hospitalisation in the intensive care unit or ventricular external drainage placement, a great majority of sSAH patients were treated in our institution. Among the 304 sSAH patients, only 35 did not have records in our department; we reached their records via 112 EHSS records.

The sSAH patients have been diagnosed in the emergency department or in an external clinic and all of them were hospitalised in our neurosurgery department or in the intensive care unit under our supervision. All ICD10 codes related to the cerebrovascular diseases were screened via the hospital automation system. The records of sSAH diagnosed cases were analysed in detail. Accessible data such as name, surname, mother's name, father's name, place of birth, the hospital protocol number, social security number and citizenship number were used to avoid any duplication. Additionally, the data of the patients who were referred to external centres with sSAH diagnosis was also obtained via 112 EHSS records. Age, sex, WFNS (World Federation of Neurosurgical Societies) SAH Grade depending on Glasgow Coma Scale (GCS), the presence or the absence of focal deficits at admission, date of onset, medical history, place of residence, the sSAH etiology and the clinical status at discharge (using Glasgow Outcome

Table 2 Diagnostic parameters of hospitalised patients

	n	%
All patients	269	100
sSAH diagnosis via CT	262	
sSAH diagnosis via LP	9	
WFNS grade 1	137	50.9
WFNS grade 2	49	18.2
WFNS grade 3	14	5.2
WFNS grade 4	44	16.4
WFNS grade 5	25	9.3
Further investigation via DSA	209	
Further investigation via MRI and MR angiography	63	
Lesion negative	49	18.2
Lesion positive	179	66.5
Without any further diagnostic assessment	41	15.2

Two patients were diagnosed via LP in addition to CT. Three patients were diagnosed via MRI in addition to DSA. *CT*, computerised tomography; *LP*, lumbar puncture; *DSA*, digital subtraction angiography; *MRI*, magnetic resonance imaging

Scale, GOS) were recorded. Since the study was planned in the adult patient group, all of the adult patients included to the study were age 18 or more, resident in Edirne, and diagnosed with sSAH between the years of 2007 and 2011.

We calculated the sSAH incidence using the census data of Edirne for the years 2007 to 2011. We chose that date interval because the Turkish Statistical Institute (TUIK) started to declare the census information was annually after 2006. The study was approved by the ethical committee of Trakya University in 2012 (TÜTF-GOKAEK 2012/95).

Statistical analysis

The direct standardisation method was used for the purpose of standardisation of incidence rates by age and sex. The standardised incidence rates were presented together with 95% confidence intervals based on the assumption of Poisson distributed number of cases. Results are expressed as mean ± standard deviation or number (percentage). IBM SPSS Statistics 21 statistical software (IBM SPSS Statistics 21, SPSS inc., an IBM Co., Somers, NY) was used for statistical analysis.

Results

We detected a total of 693 patients with sSAH diagnosis between the years of 2000 and 2011. Three hundred four patients were diagnosed with sSAH between 2007 and 2011. Among them, 154 patients were resident in Edirne. One hundred nineteen of them were hospitalised and treated in our hospital. Thirty-five were referred to medical centres out of Edirne via 112 EHSS.

The estimated incidence of hospitalised sSAH patients in Edirne

Between January 2007 and December 2011, 304 patients were diagnosed with sSAH. Among them, 154 were resident in Edirne, 72 were men (46.8%) and 82 (53.2%) were women; mean age was 60.8 years and age range was 23–85 years. The data is summarised in Tables 1 and 2.

The population demographics for Turkey and specifically for Edirne between 2007 and 2011 are summarised in Figs. 3 and 4 according to the census declared annually by the Turkish Statistical Institute (TUIK) in Turkey.

The overall annual adjusted incidence rate for sSAH was 10.3 per 100,000 (95% confidence interval = 10.2–10.3). Annual adjusted incidence rate was 10 per 100,000 (95% confidence interval = 10–10.1) for men. For women, it was 10.4 per 100,000 (95% confidence interval = 10.4–10.5). For both sexes, after the 6th decade, the annual incidence rate of sSAH was higher than 10 per 100,000, reaching over 20 per 100,000 after the 7th decade (Table 3).

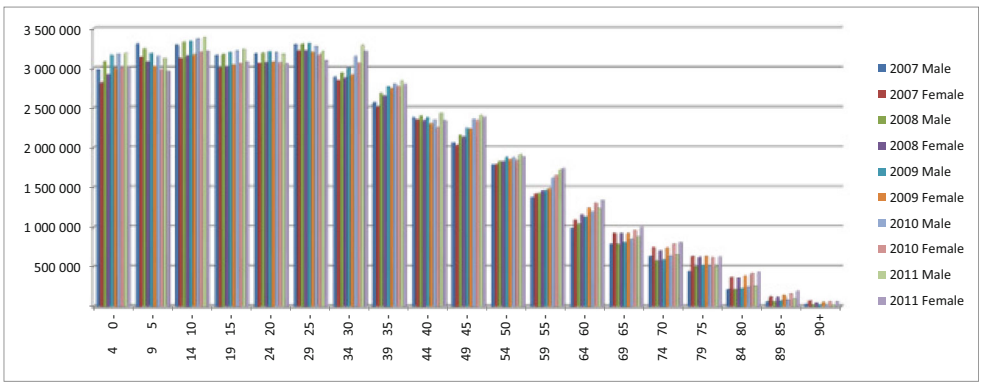

Fig. 3 Turkey population graphics (2007–2011)

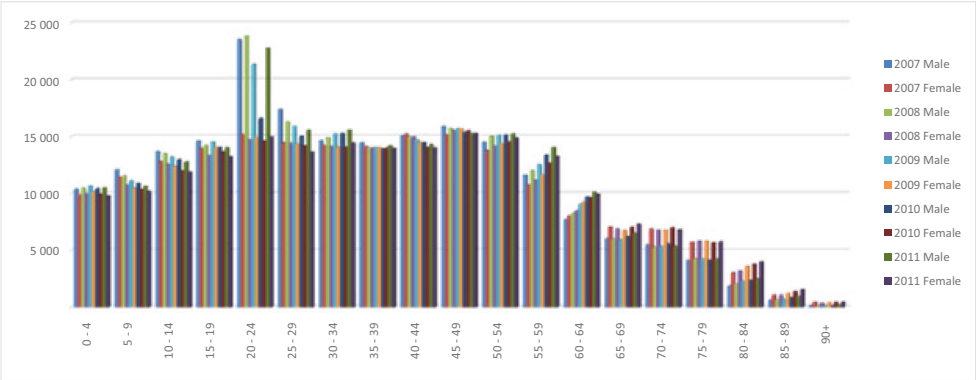

Fig. 4 Edirne population graphics (2007–2011)

The overall crude incidence rate for sSAH was 10.3 per 100.000 person-years. For men, the crude incidence rate was 9.4 per 100.000 person-years and for women, it was 11.2 per 100.000 person-years (Table 4).

Aneurysmatic subarachnoid haemorrhage: our clinic's experience

Two hundred sixty-nine out of 304 patients diagnosed with sSAH during the study period were hospitalised in our department. A total of 41 of the 269 hospitalised patients could not be examined further because they died early or referred to an external centre. Of the 228 patients, 170 had an aneurysm, three had an aneurysm in addition to an arteriovenous malformation (AVM), one had AVM, four had sinus vein thrombosis and one had venous angioma. The aneurysm detection rate was 75.9% (173/228) in the patients who were examined. The lesion detection rate was 78.5% (179/228). Data on lesions' type and location are summarised in Table 5.

Discussion

sSAH incidence differs in different regions of the world. The ideal study to obtain an accurate incidence can be executed when the subject area is isolated and has a well-established patient-referring system. It is difficult to perform epidemiological studies in countries whose health system is not well organised and especially in the absence of clear census information.

We calculated the incidences using the clinical data obtained from adult patients admitted to the hospitals in Edirne and we did not include autopsy results. In the literature, it is reported that approximately 20% of the sSAH patients die before reaching any hospital [10]. Using the results, we obtained and the literature knowledge, the sSAH incidence of Edirne can be estimated.

Different results have been reported in various countries around the world in various seasons [1–6, 9, 11, 12, 14–25]. Our results are within the range claimed in the literature, thus close to the world average. In a study conducted in Northern Greece, in Evros Province which is close to Edirne, 51 subarachnoid haemorrhage cases have been recorded in 5 years of period. The crude annual incidence rates were 8.3, 7.5 and 7.9 per 100,000 person-years for men, for women and for all subjects respectively [23]. In the literature, the incidence difference between the regions is attributed to the frequency of the risk factors such as smoking, hypertension and excessive use of alcohol [1, 10].

Table 3 Age-adjusted incidence rates

	Female				Male				Total			
	Population	Cases	Adj. rate	95% CI	Population	Cases	Adj. rate	95% CI	Population	Cases	Adj. rate	95% CI
2007	144,900	14	9.0	8.9–9.2	152,888	15	10.4	10.3–10.6	297,788	29	9.7	9.6–9.8
2008	145,368	15	9.8	9.6–9.9	153,107	11	7.7	7.6–7.8	298,475	26	8.7	8.6–8.8
2009	147,034	21	13.5	13.4–13.7	152,053	11	7.7	7.5–7.8	299,087	32	10.7	10.6–10.8
2010	148,293	12	7.5	7.3–7.6	147,972	20	14.3	14.2–14.5	296,265	32	10.8	10.7–10.9
2011	149,860	20	12.2	11.7–12.7	156,531	15	10.0	9.5–10.5	306,391	35	11.4	11.3–11.5
Adj. rate		10.4			10.0				10.3			
95% CI		10.4–10.5			10.0–10.1				10.2–10.3			

CI, confidence interval; *Adj. rate*, adjustment rate

Table 4 Crude incidence rates

	Total			Female			Male		
	Population	Cases	CR	Population	Cases	CR	Population	Cases	CR
20–29	333,404	3	0.9	145,347	2	1.4	188,057	1	0.5
30–39	287,028	5	1.7	140,964	4	2.8	146,064	1	0.7
40–49	301,051	20	6.6	149,712	12	8.0	151,339	8	5.3
50–59	269,382	43	16.0	130,997	19	14.5	138,385	24	17.3
60–69	155,408	38	24.5	80,079	13	16.2	75,329	25	33.2
70–79	110,719	29	26.2	62,786	22	35.0	47,933	7	14.6
≥80	41,014	16	39.0	25,570	10	39.1	15,444	6	38.9
CR	10.3			11.2			9.4		

CR, crude rate

The sSAH incidence for people who were older than 18 in Edirne is almost equal to the mean incidence value of the world. The census data showed that only 75% of the total population in Edirne consist of people who were older than 18. The population demographics between the years of 2007 and 2011 of Edirne have slight differences from those of Turkey. These differences might cause problems while projecting the findings obtained in Edirne to the general population of Turkey. The demographics which are summarised in Figs. 3 and 4 show that Turkey's general population is much younger than Edirne's and 35% of the general population is younger than 20 [7]. Therefore, the sSAH incidence in Turkey might be lower than those in Edirne due to the lower cerebral aneurysm incidence during the childhood which is the major cause of sSAH [8].

Table 5 Parameters related to the cause of sSAH

	n	%
Patients with aneurysms	173	100
Single aneurysm	146	84.4
Multiple aneurysms	27	15.6
Total number of aneurysms	215	
Cavernous segment internal carotid artery	5	2.3
Ophthalmic artery	10	4.7
Posterior communicating artery	32	14.9
Anterior choroidal artery	6	2.8
Carotid bifurcation	7	3.3
Anterior communicating artery	66	30.7
Distal part of the anterior cerebral artery	4	1.9
Medial cerebral artery	64	29.8
Posterior cerebral artery	4	1.9
Basilar artery	12	5.6
Posterior inferior cerebellar artery	5	2.3
Patients with venous thrombosis	4	
Patients with AVM	4	
Patient with venous angioma	1	

Some patients had multiple aneurysms or multiple lesions as the potential cause, such as an AVM in addition to an aneurysm. *AVM*, arteriovenous malformation

The data we obtained shows that high-grade patients according to WFNS SAH grading scale were treated in the intensive care unit but not in the neurosurgery department. This finding can be explained by the observation of these patients in the intensive care unit after the urgent surgery performed.

The main limitation of the study is the unknown number of undiagnosed patients, probably dead before reaching any medical aid. We could not collect reliable information about the causes of death neither clinically nor by autopsy. In addition to this, despite our meticulous approach to frame the area and the population precisely, we could not collect information about the patients possibly treated in other health institutions.

Our study adds the first estimation data of the sSAH incidence in Edirne, also in Turkey to global knowledge. Even though the approximation data is rough, the collected data might be used to estimate the overall epidemiological aspect of sSAH in Turkey. We hope that this study would lead up future investigations in different parts of Turkey to enlighten the epidemiological state of affairs and course of sSAH in Turkey.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Ethical approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed consent For this type of study, formal consent is not required.

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