

## ORIGINAL ARTICLE

# Assessment of timely detection of abdominal aortic aneurysm in serbian population based on the data from serbasc registry of operated patients

✉ Slobodan Pešić<sup>1</sup>, Slobodan Tanasković<sup>2,3</sup>, Nemanja Stepanović<sup>4,5</sup>, Vuk Joković<sup>6</sup>, Aleksandar Tomić<sup>7,8</sup>, Srđan Babić<sup>2,3</sup>, Andrija Roganović<sup>9</sup>, Miroslava Popović<sup>10</sup>, Igor Končar<sup>9,3</sup>

- <sup>1</sup> General Hospital of Subotica, Department of Surgery/Vascular Surgery Division, Subotica, Serbia  
<sup>2</sup> Vascular Surgery Clinic, Dedinje Cardiovascular Institute, Belgrade, Serbia  
<sup>3</sup> University of Belgrade, Faculty of Medicine, Belgrade, Serbia  
<sup>4</sup> Vascular Surgery Clinic, University Clinical Center of Niš, Niš, Serbia  
<sup>5</sup> University of Niš, Faculty of Medicine, Niš, Serbia  
<sup>6</sup> Center for Vascular Surgery, University Clinical Center Kragujevac, Kragujevac, Serbia  
<sup>7</sup> Clinic for Vascular and Endovascular Surgery, Military Medical Academy, Belgrade, Serbia  
<sup>8</sup> University of Defence, Faculty of Medicine of the Military Medical Academy, Belgrade, Serbia  
<sup>9</sup> Clinic for Vascular and Endovascular Surgery, University Clinical Centre of Serbia, Belgrade, Serbia  
<sup>10</sup> Clinic for Surgery, Department for Nephrovascular Surgery, Zvezdara University Medical Center, Belgrade, Serbia

**Received:** 10 December 2022

**Revised:** 8 January 2023

**Accepted:** 16 February 2023



Check for updates

## Funding information:

The authors received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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## Competing interests:

The authors have declared that no competing interests exist

## ✉ Correspondence to:

Slobodan Pešić, General Hospital of Subotica, 3, Izvorska Street, 24 000 Subotica, Serbia, Phone: +381 24 555 222, mob +381 61 6303360. E-mail: spesic90@gmail.com

## Summary

**Introduction** Screening of males over 65 years of age for abdominal aortic aneurysm (AAA) has been proved effective in some countries. The incidence of AAA in Serbian population has not been evaluated yet.

**The aim** of the study was to assess the ratio between elective and urgently operated patients with AAA and to estimate hospital incidence of treated AAA based on the population of 100 000 inhabitants.

**Methods** Data were obtained from Vascular surgery registry - Serbasc which has been created by 17 institutions. Data containing demographic characteristics were obtained from the publication of the Statistical office of the Republic of Serbia. For statistical analysis, the methods of descriptive statistics were used and the values were expressed per 100 000 inhabitants.

**Results** During the year 2021, 422 operations were performed in 7 hospitals due to asymptomatic, symptomatic and ruptured AAA in 323 (76,54%), 37(8,76%) and 62 (14,69%) patients, respectively. Hospital incidence of electively operated AAA is 8,06 cases per 100 000 inhabitants, whereas the incidence of operated ruptured AAA is 1,55 cases per 100 000 inhabitants. Overall hospital incidence of all operatively treated AAA is 10,53 cases per 100 000 inhabitants. Out of the total number of operated patients with AAA, 134 (31,75%) were younger than 65 years, while 22 (35%) out of 62 patients treated for rAAA, where younger than 65 years.

**Conclusion** The incidence of operatively treated elective AAA is lower than the values reported in literature, while the rate of ruptured AAA is more than twice as high as the rate reported by recent papers. One third of treated patients were younger than 65 years. The most efficient strategy for reducing the number of urgently treated AAA is the implementation of screening for AAA in groups with higher risk.

**Key words:** Abdominal aortic aneurysm, registry, hospital incidence

## INTRODUCTION

Abdominal aortic aneurysm (AAA) is defined as abnormal dilatation of the abdominal aorta  $\geq 3.0$  cm, or dilatation of more than 50% of its diameter.<sup>1</sup> According to literature it is more common in men, in cigarette smokers and in persons with hypertension or obesity. During the past two decades a drop in newly discovered cases of AAA per year has been noticed, from the previous incidence of 30,1 - 40 per 100.000 inhabitants to the currently estimated incidence of 13,2 - 16 per 100.000 inhabitants.<sup>2,3,4,5,6</sup> From the moment the diagnosis of AAA is made, life expectancy is 11 years.<sup>7</sup> Aneurysm diameter above 5,5 cm is a threshold above which the operative treatment is recommended.<sup>8</sup>

The most serious risk of living with AAA is the risk of aneurysm rupture which is the most common and potentially fatal complication. The only chance for surviving AAA rupture is emergency operative treatment. Cumulative mortality in AAA rupture is above 80% because most patients cannot make to the healthcare institutions which are involved in definitive treatment. Hospital mortality is up to 50%.<sup>1</sup> AAA rupture is the 13<sup>th</sup> cause of death in men over 55 years of age in western world. On the other hand, mortality as a result of elective surgery of AAA is below 5%,<sup>5</sup> and in high volume centers it is below 2%.<sup>9</sup>

This high mortality rate can be prevented by early detection and elective treatment of aneurysm. Internationally, there have been four large randomized studies in general population which estimated the effects of AAA screening by one time ultrasound (US) examination in men over 65 years of age (*Chichester*<sup>7</sup> - Great Britain, *MASS*<sup>10</sup> - multicentric screening study, Great Britain, *Viborg*<sup>11</sup> - Denmark, *WA*<sup>12</sup> - Western Australia). The studies showed that screening program had resulted in reducing AAA related mortality by 40% and reducing ruptured AAA incidence by 38%<sup>13</sup>, after 3-5 years of follow up, but that it had not contributed to lowering the overall mortality. A long term follow-up showed an increase in the number of elective AAA procedures, a decrease in the number of emergency AAA procedures as well as a significant reduction in 30-day postoperative mortality due to all AAA procedures.<sup>14</sup> Literature data about frequency and the total number of ruptured AAA in our country are scarce and so far a study on justification of AAA screening has not been conducted. Certainly, data on the number of electively treated patients with AAA and the number of urgently treated patients due to ruptured AAA (rAAA) would be one of the first indicators for the necessity of AAA screening in our country.

The aim of this study was to assess the ratio between electively and urgently operated patients with AAA and to estimate hospital incidence of treated AAA based on the population of 100 000 inhabitants.

## MATERIAL AND METHODS

Data on primary procedures for treating AAA in the year 2021 were prospectively collected in vascular surgery registry - *Serbvasc*. Primary procedures included surgically treated (open and endovascular) asymptomatic, symptomatic and ruptured AAAs. Overall, 17 healthcare institutions took part in the creation of *Serbvasc* registry (Clinic for Vascular and Endovascular Surgery of University Clinical Center of Serbia, Institute for Cardiovascular Diseases Dedinje, Clinic for Vascular Surgery of Military Medical Academy, Clinical Centre (CC) of Nis, Clinical Centre of Kragujevac, Zvezdara University Medical Centre, Zemun University Medical Centre, General Hospital Subotica, General Hospital Užice, General Hospital Kruševac, General Hospital Valjevo, General Hospital Zrenjanin, General Hospital Kikinda, General Hospital Sremska Mitrovica, General Hospital Požarevac, General Hospital Gornji Milanovac), however AAA are treated only in 7. Data containing demographic characteristics of the population that gravitates towards the institutions that create *Serbvasc* register are gathered from (currently latest) publication of the Statistical Office of the Republic of Serbia.<sup>15</sup>

Serbian vascular registry (SERBVASC) was founded at the beginning of the year 2020, although full data collection began in 2021, delay being caused by COVID-19 pandemic. The registry was developed in cooperation with the international network of vascular registries, VASCUNET, which collects data from most European Union countries, New Zeland, Australia and Serbia and collaborates with similar organizations in North America. Most Serbian hospitals agreed to contribute to the collection of data in SERBVASC registry and gained Ethical approval in their institutions.

Descriptive statistics methods were used for statistical analysis and values are showed per 100.000 population. Correlation and regression analysis were used for the analysis of variables. Statistical hypothesis testing was made at the level of significance of  $p < 0,05$ .

## RESULTS

According to the data from the Statistical Office of the Republic of Serbia, the total number of inhabitants in administrative areas which gravitate towards healthcare institutions that create SERBVASC registry is 4.006.463. A total of 679.165 are older than 65 years. (**Table 1.**)

In the period January - December 2021, 422 operations of AAA were performed. Out of the total number of treated, 323 (76,54%) operations of AAA were performed in elective settings, 37 (8,76%) to treat symptomatic AAA and 62 (14,69%) to treat ruptured AAA. The total number of urgently treated patients for symptomatic and ruptured AAA is 99 (23,46%).

**Table 1.** The number of inhabitants according to administrative areas that gravitate towards healthcare institutions which create Vascular surgery registry - *Serbvasc*

Administrative area (Healthcare institution towards which the population gravitates)	The total number of inhabitants	The number of inhabitants older than 65 years
Belgrade district (CVEH UCCS*, ICVDD#, MMA°, UMC¥ Zvezdara, UMC Zemun)	1 659 440	266 762
Nišava district (CC° Niš)	376 319	71 563
Šumadija district (CC Kragujevac)	293 308	49 925
North Bačka district (GH§ Subotica)	186 906	31 973
Zlatibor district (GH Uzice)	286 549	50 345
Rasina district (GH Krusevac)	241 999	34 837
Kolubara district (GH Valjevo)	174 513	33 123
Srem district (GH Sremska Mitrovica)	312 278	51 168
Kikinda (GH Kikinda)	59 453	9 786
Central Banat district (GH Zrenjanin)	187 667	32 119
Braničevo district (OB Požarevac)	183 625	39 065
Gornji Milanovac (GH Gornji Milanovac)	44 406	8 499
<b>Total</b>	<b>4 006 463</b>	<b>679 165</b>
	*CVEH UCCS – Clinic for vascular and endovascular surgery of University Clinical Center of Serbia # ICVDD – Institute for cardiovascular diseases Dedinje ° MMA – Military Medical Academy ¥ UMC – University Medical Center ° CC – Clinical Center § GH – General Hospital	

**Graphic 1.** The number of treated patients with asymptomatic, symptomatic and ruptured abdominal aortic aneurysms according to months in year 2021.

The incidence of operatively treated rAAA in the examined population in the year 2021 is 1,55 cases per 100.000 inhabitants. The total incidence of all urgently treated AAA (symptomatic and ruptured) in the examined time frame is 2,47 cases per 100.000 inhabitants. The incidence of electively treated patients with AAA is 8,06 cases per 100.000 inhabitants. The overall incidence of all operatively treated patients for all AAA in the examined time frame is 10,53 cases per 100.000 inhabitants.

Out of the total number of operated patients with AAA (422), 288 (68,25%) were older than 65 years. The incidence of patients older than 65 years treated for all AAA is 42,40 cases per 100.000 inhabitants older than 65 years. Out all 62 patients treated for rAAA, only 40 (65%) of were older than 65 years. The incidence of treated rAAA in patients older than 65 years is 5,89 cases per 100.000 inhabitants older than 65 years.

## DISCUSSION

This prospective study examined hospital incidence of operated AAA on the population of 100 000 inhabitants and the ratio of elective and urgent procedures (due to symptomatic and ruptured AAA) in the examined population without exclusion of subjects concerning sex and age. This enabled the evaluation of influence and share of emergent AAA operations with regard to overall hospital incidence of AAA operations. The estimated values differ from those in international publications.

In the examined population, the incidence of all treated AAA (elective and urgent) is 10,53 cases per 100.000 inhabitants per year. This incidence is lower than previously published hospital incidence on European population in other countries, which is within the range of 13,2 to 15,7 per 100.000 inhabitants.<sup>5,6</sup> The incidence of treated rAAA in this study (1,55 cases per 100.000 inhab-

itants) is also lower than the incidence of treated AAA ruptures in literature, which is 1,6 cases per 100.000 inhabitants.<sup>6</sup> According to literature data, it has also been shown that out of the total number of ruptured AAA, 41% to 52% of those admitted to hospital are not operatively treated.<sup>6,16</sup> Consequently, the incidence of rAAA is significantly higher than the number of treated rAAA. On the other hand, the rate of untreated patients admitted due to rAAA in Serbian hospitals is somehow lower due to local practice.<sup>17,18</sup>

This lower incidence rate of treated AAA cases can be explained by a lower rate of detection and treatment of existing AAA. Since there is no evidence of waiting lists in Serbian hospitals when it comes to the treatment of AAA, one can assume that the lower rate of detection is the cause of this unfavorable ratio between elective and urgent procedures for treating AAA. There is a significant difference between the incidence of elective treated AAA and the estimated values in literature, 8,06 cases per 100.000 inhabitants in the examined population versus 13,1 cases per 100.000 inhabitants in literature.<sup>6</sup>

Burden and share of emergently operated AAA, which have a higher mortality rate, is more than twice as high in our examined population in comparison with literature. From the total number of operated AAA, 23,46% is treated urgently which is more than twice as high as the share of 10,99% of urgently treated in literature<sup>5</sup>.

When the distribution of AAA operations is assessed by age groups, it becomes evident that more than two thirds of operations are performed at patients older than 65 years. Also, an increase in the incidence of AAA operations is significant in subjects older than 65 years, with the value of 42,40 cases per 100.000 inhabitants other than 65 years. More than two thirds of treated ruptured AAA is in patients older than 65 years, while in reported European population this share of treated rAAA is in population older than 75 years.<sup>19,20</sup> This share of rAAA in the population which is a decade younger than the one reported in literature requires a deeper analysis. The presence of risk factors in Serbian population is higher than in Western Europe and the quality of life due to economic situation is lower whereas stress exposure is higher. Higher rates of rAAA means higher costs for healthcare system and a greater burden for vascular departments with urgent patients.

A possible strategy for reducing the rate of rAAA is the introduction of screening program for AAA. Internationally, screening for AAA is applied by ultrasonography of the abdomen in men older than 65 years. Ultrasonography of abdomen is a very sensitive and specific noninvasive test for detection of all AAA regardless of diameter. Ultrasound based screening for AAA fulfills all criteria for a screening program recommended by the World Health Organization (WHO).<sup>21</sup> Meta-analyses of randomized controlled performed on large population showed that screening for AAA reduces AAA

related mortality by 40% after follow-up period of 3-5 years.<sup>7,10,11,12</sup> According to the data from large randomized studies, after the period of follow up of 13-15 years, screening reduces the prevalence of rAAA by 55% and increases the number of electively treated AAA by 1,35 times.<sup>14</sup> Estimated screening induced absolute risk reduction (ARR) in AAA mortality is the same or higher than ARR in death from breast cancer with mammography screening, ARR in death from colorectal cancer by fecal occult blood screening or ARR in death from prostate cancer screening.<sup>13</sup> Cost-benefit analyses showed that screening for AAA was cost effective for the incidence of AAA as low as 0,5%.<sup>22,23</sup>

Better understanding of epidemiology, risks and outcome of urgently operated AAA events in the examined population can shape a future screening strategy. Data from vascular surgery registry - *Serbvasc* can be of paramount importance for understanding the effectiveness and justification of screening for AAA in general population and therefore, it is important to continue to follow the number of operated patients and the inclusion of other healthcare institutions in the development of this registry.

The study has certain limitations. Not all hospitals performing aortic procedures were included in this analysis due to different reasons specific for this kind of data collection (noncompliance of medical staff or administration of hospitals to enter data in the registry or participate in such a voluntary project). We estimate that the number of treated patients in these hospitals is not higher than 20% of all reported in this paper. The report from the National Statistical office are based on the data from 2011 and the number of inhabitants might have decreased due to constant migration in the Balkan countries. Still, younger population is more prone to migrations. Finally, the year 2021 was a pandemic year and potentially the number of patients treated by elective repair is lower than usual. However, we speculate that also the number of urgently treated patients could be lower due to the hesitation of patients to come to hospital regardless the symptoms or incapability of health care system to provide high quality care to all patients, which was the case in all countries during the pandemic.

## CONCLUSION

Hospital incidence of electively treated AAA in the examined population is lower than the values reported in literature, which is probably due to lower detection rate. For the same reason, the rate of rAAA in the total number of treated AAA is more than twice as high as the one reported in literature. Still one third of patients in Serbian population is younger than 65 years which should be considered in the screening program. *Serbvasc* registry can be an effective tool for monitoring not only the number and effectiveness of surgical procedures but also for the

assessment of epidemiological data, justification and effectiveness of a screening program implementation and the effects of its conduction later as well.

## Acknowledgement

We would like to thank all colleagues who participated in entering the data in the registry: Aleksandra Vujcic, Anica Ilic, Ognjen Kostic, David Matejevic from Clinic for Vascular and Endovascular Surgery of University Clinical Center of Serbia; Mihailo Neskovic, Igor Atanasijevic,

Aleksandar Babic, Enes Ljatifi, Marko Nikolic, Petar Zekic from Institute for Cardiovascular Diseases Dedinje; Rasa Zoranovic from Clinic for Vascular Surgery of Military Medical Academy; Zoran Damjanovic, Jasmina Zivkovic from Vascular Surgery Clinic, University Clinical Center of Niš; Rajko Minic from Center for Vascular Surgery, University Clinical Center Kragujevac; Marijana Bogosavac from Zvezdara University Medical Center; Mihajlo Zwick, Snezana Tulencic-Egic from General Hospital Subotica and Nebojsa Lucic, Jelena Stankovica and Ivan Vukasinovic from General hospital Uzice.

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## PROCENA PRAVOVREMENOG OTKRIVANJA ANEURIZME ABDOMINALNE AORTE U SRPSKOJ POPULACIJI NA OSNOVU PODATAKA IZ SERBVASC REGISTRA OPERISANIH PACIJENATA

Slobodan Pešić<sup>1</sup>, Slobodan Tanasković<sup>2,3</sup>, Nemanja Stepanović<sup>4,5</sup>, Vuk Joković<sup>6</sup>, Aleksandar<sup>7,8</sup>, Tomić, Srđan Babić<sup>2,3</sup>, Andrija Roganović<sup>9</sup>, Miroslava Popović<sup>10</sup>, Igor Končar<sup>9,3</sup>

### Sažetak

**Uvod** Skrining muškaraca starijih od 65 godina na aneurizmu abdominalne aorte (AAA) se pokazao efikasnim u zemljama koje ga primenjuju. Do sada nije procenjena incidenca AAA u srpskoj populaciji.

**Cilj** studije je bio da se proceni odnos elektivno i hitno operisanih bolesnika sa AAA i incidenca tretiranih AAA prema broju stanovnika tokom 2021. godine shodno populaciji u ispitivanim regionima Republike Srbije.

**Materijal i metode** Podaci su dobijeni iz registra vaskularnih operacija - Srbvasc u čijem kreiranju učestvuje 17 ustanova. Podaci o demografskim karakteristikama stanovništva za izračunavanje učestalosti dobijeni su iz publikacije Republičkog zavoda za statistiku Republike Srbije. Za statističku analizu podataka korišćene su metode deskriptivne statistike, a vrednosti su iskazivane na 100 000 stanovnika.

**Rezultati** Tokom 2021. godine izvršene su 422 operacije AAA u 7 ustanova, 323 (76,54%) zbog asimptomatske, 37

**Ključne reči:** aneurizma abdominalne aorte, registar, incidencija

**Primljen:** 10.12.2022. | **Revizija:** 08.01.2023. | **Objavljen:** 16.02. 2023

**Medicinska istraživanja 2023; 56(1):9-14**

(8,76%) zbog simptomatske AAA i 62 (14,69%) zbog rupturirane AAA. Incidenca elektivno operisanih AAA je 8,06 slučajeva na 100 000 stanovnika, incidenca operativno tretiranih rupturiranih AAA je 1,55 slučajeva na 100 000 stanovnika. Ukupna incidenca svih operativno tretiranih AAA je 10,53 slučaja na 100 000 stanovnika. Od ukupnog broja tretiranih AAA njih 134 (31,75%) su bili mlađi od 65 godina a 22 (35%) od 62 tretirana pacijenata sa rAAA je bilo mlađe od 65 godina.

**Zaključak** Incidenca operativno tretiranih elektivnih AAA u ispitivanoj populaciji na 100 000 stanovnika je manja u odnosu na prijavljene vrednosti u literaturi ali je udeo rupturiranih AAA više od dva puta veći od publikovanih vrednosti u literaturi. Značajan broj elektivno i hitno tretiranih bolesnika je mlađi od 65 godina. Najefikasniji način za smanjenje broja hitno operisanih AAA je uvođenje skrininga AAA u grupama populacije sa većim rizikom.