

## The Pattern of Publications on Cerebral Arteriovenous Malformations and Cavernomas in the Middle East and North Africa

### Abstract

**Background:** Cerebrovascular malformations are encountered frequently in clinical practice, but not much is known about the pattern of publication in the Middle East and North Africa (MENA) countries. We aim to evaluate the status and pattern of publications of cerebral arteriovenous malformations (AVM) and cavernomas in the MENA. **Materials and Methods:** PubMed database was searched for publications on cerebral AVM and cavernomas in the MENA between 2009 and 2019. **Results:** We found only 94 publications in the MENA region out of 31,333 publications pertaining to AVMs (0.3%). The highest publishing country was Turkey, with 50 (53.1%) studies. The case report was the study design used most by authors with 59 (62.7%) studies. The majority of publications were by neurosurgeons with 42 of 94 (44.4%) papers. European journals ranked first in the number of published articles with 42 of 94 (44.6%) articles. **Conclusions:** We found a limited number of publications on cerebral AVMs and cavernomas by MENA countries in the past decade. Research support and national/regional registries are important factors to improve the academic output on AVMs and cavernomas in the MENA region.

**Keywords:** Arteriovenous malformations, cavernous malformations, Middle East, North Africa, pattern, publications

### Introduction

Cerebrovascular malformations are a group of rare conditions that includes arteriovenous malformations (AVM) and cavernous malformations.<sup>[1,2]</sup>

Cavernous malformations (cavernomas) are the most common type of cerebral vascular abnormalities and account for (10%–25%) of all vascular malformations.<sup>[3]</sup> Cavernomas are an abnormal cluster of distended blood spaces that are characterized by multiple dilated “caverns” of blood vasculature. These spaces have a high tendency to leak since they lack the tight cell-to-cell junctions in addition to the weak supportive structures from smooth muscle and elastin surrounding them.<sup>[4]</sup>

The incidence of cavernomas is estimated to be 0.4%–0.8% in the general population without clear gender predilection. They occur in both adults and children, though the mean patient age is in the fourth decade.<sup>[3]</sup> Seizures were the most common presenting symptom with 44.4%, followed

by headache (30.6%) and neurological deficits (30.6%). Most of cavernomas were found in cerebral hemispheres (66.7%), spinal cord (13.9%), brain stem (11.1%), and cerebellum (11.1%).<sup>[5]</sup>

AVMs are abnormal complex tangles of blood vessels which cause numerous shunts between the arterial and venous systems. They frequently occur in the brain and to a lesser degree in the spinal cord.

Cerebral AVMs present with intracranial hemorrhage (38%–71%), followed by seizures (18%–40%) and headaches (5%–14%).<sup>[6]</sup> AVMs occur in approximately 4% of the population and might be symptomatic in 12% of affected individuals.<sup>[7]</sup> There is no gender predilection and are located supratentorially in 85% and infratentorially in 15% of patients.

The main options for the management of AVM include conservative management with serial imaging and observation, microsurgical resection, endovascular embolization, and stereotactic radiosurgery.<sup>[5]</sup> The combined or staged

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therapy is also gaining popularity through multidisciplinary decision-making approaches.

Given all these epidemiological and treatment option information presented in international literature, there is a considerable lack of such data in our Middle East and North Africa (MENA) region.

This study aims to evaluate the status of cerebral AVMs and cavernomas in MENA countries through the pattern and impact of their publications.

### Materials and Methods

This study is based on a systematic review of the literature. PubMed database was comprehensively searched using the search strategy, as depicted in Table 1. Articles for this study were included if they were (1) written in English (2) published from January 1, 2009 to December 31, 2019 (3) related to cerebral AVMs and cavernomas, and (4) published in MENA countries by identification of the corresponding author’s affiliations. We excluded letters to editors and studies that include vascular pathology other than cerebral AVMs and cavernomas. This was conducted by the first and senior author.

Several parameters were extracted from each article, such as title, year of publication, corresponding author’s specialty and affiliation, study design, journal name, journal impact factor, and method of treatment. This was conducted by all the authors, the medical expertise of whom ranges from medical intern, to a neurovascular specialist to a neurovascular consultant.

### Results

We found a total of 31,333 articles published in the English literature pertaining to AVMs. When we applied our MeSH criteria stated earlier, we retrieved a total of 274 published articles from the MENA region. After exclusions, only 94 (0.3%) met our search criteria. The country with the highest number of publications was Turkey, with 50 (53.1%) publications, followed by Israel 15 (15.9%) then Iran 9 (9.5%). The remainder of the countries is

shown in Figure 1. No publications were found in Kuwait, Bahrain, Qatar, the United Arab Emirates, Oman, Yemen, Iraq, Syria, Jordan, Palestine, Algeria, Libya, or Sudan. Regarding publications by the type of study design, case reports were the most common study method used with 59 (62.7%) studies [Figure 2]. When addressing the specialty of the main author, neurosurgeons ranked first with 42 (42.4%) publications compared to the interventional radiologists with 29 (29.2%) and other specialties with 28 (28.2%) [Figure 3]. We found 42 (46.1%) publications in European journals and 24 (26.3%) in North American-based journals, followed by Middle Eastern and Asian journals, as shown in Figure 4. There has been a fairly steady distribution of the publication output between 2009 and 2019, with two peaks occurring in 2010 and 2017 with 14 and 16 publications, respectively [Figure 5].

Analyzing the modalities of treatment reported in the publication of the top three countries, we found that the majority of authors reported conservative management (45%). Microsurgical resection was the second management strategy employed to treat these patients (23%), followed by endovascular therapy (13%) [Figure 6].

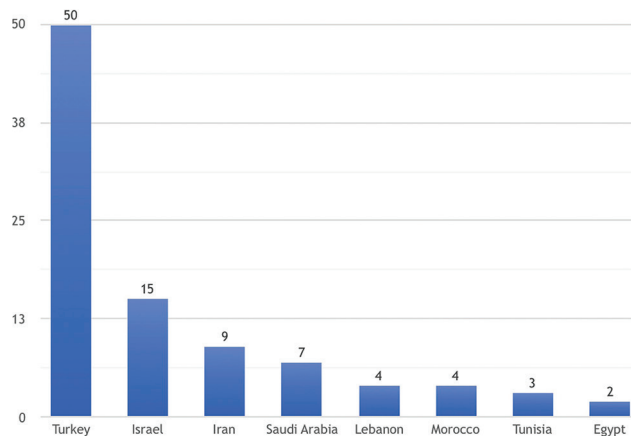


Figure 1: Publications by country

Table 1: Search strategy sorted by Best Match at PubMed

Search terms	Best Match search information	Number of items obtained	Number of items that met the inclusion criteria
(Cerebral cavernous malformation OR intracranial cavernous malformation OR cerebral cavernous hemangioma OR cerebral cavernoma OR brain arteriovenous malformation OR cerebral arteriovenous malformation OR intracranial arteriovenous malformation) AND (Saudi Arabia OR Kuwait OR Bahrain OR Qatar OR United Arab Emirates OR Oman OR Yemen OR Iraq OR Syria OR Lebanon OR Jordan OR Israel OR Palestine OR Egypt OR Tunisia OR Morocco OR Algeria OR Libya OR Sudan OR Iran OR Turkey)	MeSH Terms: Qatar; Kuwait; Turkey; Cerebrum; Brain; Israel; Hemangioma, Cavernous; Hemangioma, Cavernous, Central nervous system; Iraq; Egypt; Syria; arteriovenous malformations; Jordan; Algeria; Congenital abnormalities; Iran; Saudi Arabia; Libya; the United Arab Emirates; Lebanon; Yemen; Morocco; Oman; Sudan; Tunisia; Turkey; Intracranial arteriovenous malformations; Bahrain Subheading: Abnormalities	274	94

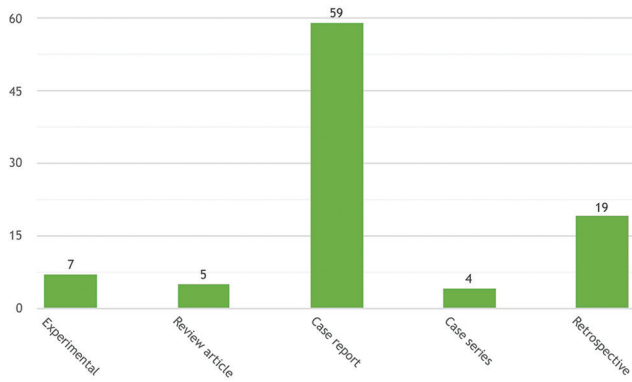


Figure 2: Publications by the type of study design

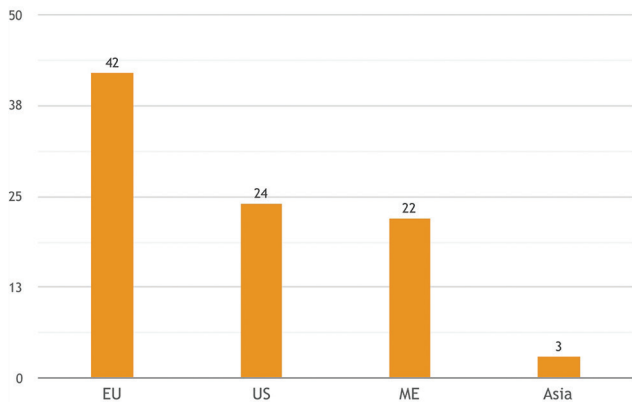


Figure 4: Publications by the region of journal

With regard to gross domestic product (GDP) and current health expenditure (CHE) and influence on publications, two of the top three countries, namely Turkey and Iran, were middle-class income countries with nearly equal CHE per capita of USD 444.7 and 475.5, respectively.

### Discussion

Currently, improving the organization and the outcome of health-care services remains a crucial issue of concern in the MENA region. MENA region covers an area of around 11 million km<sup>2</sup> and contains approximately 5.7% of the world's population. The epidemiological and demographic variations have a major influence on the organization and the outcome of health care in MENA countries.<sup>[8]</sup> Health care in MENA countries is mostly paid by governments, spending about 58% of the national total health-care expenditures. The recent years have witnessed a rapid growth of government expenditure on health-care facilities in addition to improving quality, equity, and access.<sup>[9]</sup>

These and other issues contribute to the lack of publications in the MENA region. This has been reported in the interventional literature in recent years.<sup>[10]</sup>

Based on our results, there were only 94 published articles on cerebral AVMs and cavernomas by MENA in the past

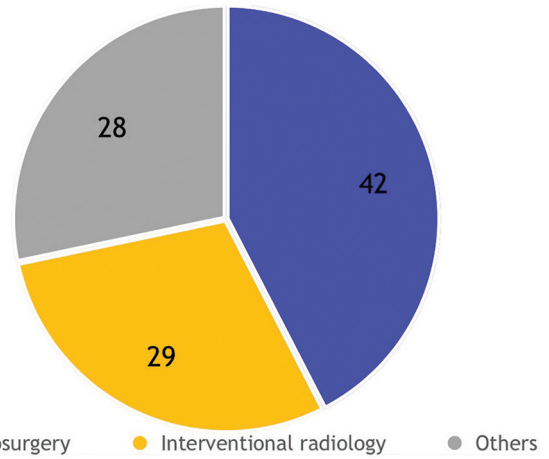


Figure 3: Publications by the main author specialty

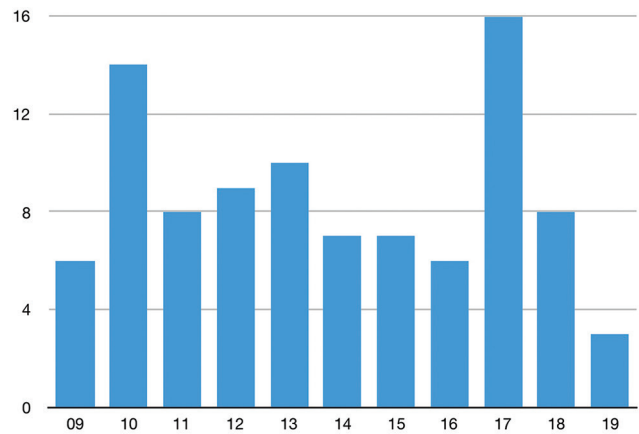
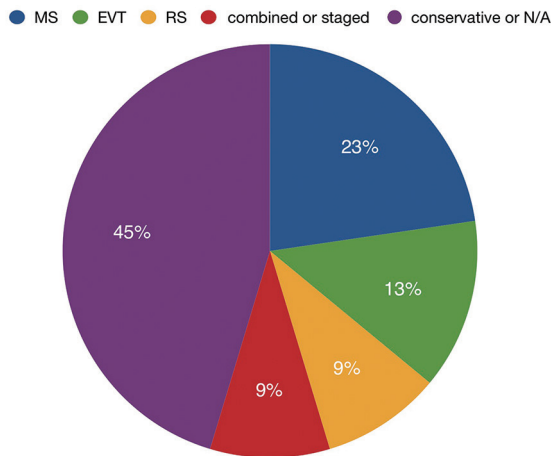


Figure 5: Distribution of publication by year

10 years out of 31.33 publications worldwide. This represents a small percentage of the bibliographic impact of the MENA region in the AVM domain. The highest publishing country was Turkey (50 [53.1%]) followed by Israel (15 [15.9%]) then Iran (9 [9.5%]) [Figure 1]. This low number of publications can be attributed to several factors, including the limited number of physicians interested in academic publishing, poor research support, and limited disease registries.<sup>[11]</sup> There are strict institutional rules and regulations that might limit the collaboration between different health-care sectors. This might, at least in theory, limit the access to data needed for future high-caliber publications.

When addressing publications by the region of the journal, we found that the majority of authors chose European journals over local journals (46.1% vs. 23.4%). This could be related to physicians' preference to publish in journals with a higher impact factor [Figure 4].

When analyzing the articles by the specialty of the corresponding author, it was found that neurosurgeons published most of the studies (42 [42.4%]) compared to interventional radiologists (29 [29.2%]) [Figure 3], which



**Figure 6: Distribution of modality of management in the 3 top publishing countries**

could be explained, in part, by the current structure of practice in the MENA countries where the interventional radiologists are not the primary physicians for these patients.<sup>[12]</sup>

Regarding publications by the type of study design, the case report was found to be the most common study method used with 59 (62.7%) articles, followed by retrospective study (19 [20.2%]) and experimental study (7 [7.4%]) respectively [Figure 2]. This is a reflection on the lack of a structured environment to conduct high-impact research projects in the MENA region.

There was no correlation between GDP and CHE per capita and the number of publications in each country, as two of the top three countries were middle-class income countries with nearly equal CHE per capita among them. This further consolidates the notion that most of these publications are driven by individual physicians' efforts rather than a structured national process.

The limitation of our study is that we limited our search to PubMed/Medline database. This strict criterion was applied to avoid reporting low-quality publications.

Despite this limitation, we could glean noteworthy findings, based on which we can propose that the role of national databases should be increased. This will allow for better evaluation systems for researches and researchers, more funding options, and more productive academic institution output.

There is a clear need to expand on AVM publications in the MENA region, which would provide a better reflection of the current regional health-care practices. To that end, we emphasize the need to establish comprehensive national or regional teams or multidisciplinary practice groups that follow the AVM patients collaboratively to improve upon treatment outcomes. In addition, there is a pressing need for construction and maintenance of disease registries, which would be of great benefit for better data collection and tracking of quality indicators for health-care delivery in the MENA region.

## Conclusion

We found a limited number of publications on cerebral AVMs and cavernomas by MENA countries in the past decade. Research support and national/regional registries are important factors to improve the academic output on AVMs and cavernomas in the MENA region.

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## Conflicts of interest

There are no conflicts of interest.

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