Development of neurosurgery in Greece: past, present, and future

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In this study the authors examine the historical tradition as well as current features of neurosurgery in Greece and compare the available data with international standards. In particular, they describe the organizational structure of neurosurgery with reference to manpower, unit distribution, training, and qualification. They discuss problems such as overproduction of neurosurgeons and the poor control of training and qualification procedures in the neurosurgical profession.

The findings are examined in a critical way and solutions are proposed that could improve the present situation.

KEY WORDS • neurosurgery in Greece • neurosurgical manpower • neurosurgical training • neurosurgical certification • neurosurgical history

Historical Evolution of Neurosurgery in Greece: A Short Review

The first account of a neurological procedure is the mythological description of the “craniotomy” performed by Vulcan (Hephaestos), the god of fire and metalworking, who opened the growing skull of Jupiter (Zeus) and freed his daughter Minerva (Athene), the goddess of wisdom. Findings from the Minoan period (2000 BCE) in the island of Crete indicate that skull trephinations were performed at that time, probably for religious reasons. Survival from burr holes or craniectomies led ancient Greeks to attempt these procedures to treat different diseases. In ancient Mycenae (approximately 125 km south of Athens) excavations of the graves of King Agamemnon, the leader of the expedition against Troy, have revealed delicately trephined skulls (1200 BCE).

The next “neurosurgical period” in Greece belongs to Hippocrates (460–377 BCE). His writings refer to the brain and spinal disease, including head trauma, and include the oldest written description of skull trephination and its special instrumentation. Galen (130–201 CE), the great physician of antiquity, also described certain brain diseases and operations. In addition, he wrote about nerve injuries and their cure by application of egg albumin, a way of enhancing the reconnection of nerve stumps. Paulus Aeginitus, a physician of the seventh century CE, described the suturing of injured nerves.

Since the establishment of the modern Greek State in 1821, there have been several records referring to neurosurgical diseases. In 1877, Spyros Maginas, a professor at the University of Athens, translated into Greek the original book of general surgery by Vassilios Rossiris, a Greek professor of surgery who resided in Magdeburg, Germany. This book includes techniques of operations on head injuries. In 1894, the physician Simon Apostolidis described five patients with neurosurgical problems. Two of them presented with epilepsy and died. The post-mortem examination report revealed the presence of tumors in the rolandic area (“sarcomas”) and suggested that: “they were excisable. Although no such operations had been performed in Greece, they are performed by the hundreds in England and the United States, and with particular success by the English surgeon, Horsley.” The other three patients sustained shotgun injuries; all underwent surgery and two of them had an excellent recovery.

In the first quarter of the twentieth century, professors of surgery such as Emmanuel Kontoleon, Konstantinos Mermigas, and Michael Makkas performed neurosurgical operations, mainly for head trauma, and published books in the Greek language with descriptions of operations on the skull, brain, spine, and nerves. From the records of Evangelismos Hospital located in Athens, it is evident that, since the early 1920s, more advanced operations on the brain and spine have been performed by eminent general surgeons (Petros Kokkalis, George Karagiannopoulos, and N. Sbarounis), and under the supervision of the neurologist John Patrikios, who routinely scrubbed and undertook postoperative care. We know of a patient who, at the age of 24 years, underwent surgery in 1926 for an
intracranial hematoma, which was performed by one of these doctors. The same patient presented in 1985 with a large contralateral calcified subdural hematoma, which subsequently was treated successfully.7

The origins of modern neurosurgery in Greece emerge with Konstantinos Eliades (1900–1962), who established the first specialist neurological department in Greece in 1940 at Agios Savvas Anticancer Hospital. Records obtained from that hospital indicate that he routinely performed intracranial and intraspinal surgery and that he also introduced more specialized procedures, such as parapontine trigeminal rhizotomy for trigeminal neuralgia.7

In 1953, Doros Economou established a modern neurosurgical unit at Athens Polyclinic. This provided the opportunity for surgeons to perform, for the first time, procedures such as: fenestration for discectomy, clipping of aneurysms, the transsphenoidal approach, stereotaxy, Holter valve insertion, Cloward’s technique, and epilepsy surgery. During the next 32 years, more than 3000 patients were surgically treated for brain tumors. Economou had trained under Clovis Vincent and Demartel in Paris and had later worked as a research fellow with Penfield in Canada.7 John Taptas, well known for his pioneering work in the cavernous sinus,18,19 chaired the Department of Neurosurgery at Agios Savvas Hospital, Athens, from 1962 to 1986. In 1966, the Hellenic Neurosurgical Society was established in Athens and Economou was elected its first president.7

In 1967, Vassilios Griponisiotis became the first professor of neurosurgery in Thessaloniki. Since 1976, this position has been held by George Foroglou, formerly president of the European Association of Neurological Surgeons training committee.13 In the early 1960s Angelos Caracalos developed stereotactic functional operations in Greece6,13 and Stamatios Komninos established the first pediatric neurosurgery department at Athens’ Children’s Hospital.13 Petros Karvounis, formerly clinical associate professor at the New Jersey College of Medicine and Dentistry and, since 1971, head of the neurosurgery service at the largest hospital in Greece, Evangelismos Hospital, became the first associate professor of neurosurgery at Athens University Medical School in 1987. Finally, in 1993, the first edition of the journal Hellenic Neurosurgery was published under the editorship of the Hellenic Neurosurgical Society.

Present Status of Neurosurgery in Greece

Neurosurgical Manpower

In Greece there are 172 certified neurosurgeons and 58 trainees for 10 million people, providing a ratio of one certified neurosurgeon per 58,000 population. Specifically, 76 surgeons are employed by the National Health System, 17 hold university positions, 10 are members of the military, and 69 are exclusively involved in private practice (Table 1). The number of certified neurosurgeons is expected to approximately double by the year 2010, whereas the population of Greece will stabilize at 10.5 million (National Statistics Service). Consequently, the approximate ratio of neurosurgeons to the total population will be 1:33,000. As a comparison, in 1970 there were only 25 neurosurgeons, or one neurosurgeon per 400,600 population.

<table>
<thead>
<tr>
<th>Type of Occupation</th>
<th>No. of Surgeons</th>
</tr>
</thead>
<tbody>
<tr>
<td>private practice</td>
<td>69</td>
</tr>
<tr>
<td>state hospital</td>
<td>76</td>
</tr>
<tr>
<td>directors</td>
<td>12</td>
</tr>
<tr>
<td>senior specialists</td>
<td>24</td>
</tr>
<tr>
<td>junior specialists</td>
<td>40</td>
</tr>
<tr>
<td>academics</td>
<td>17</td>
</tr>
<tr>
<td>professors</td>
<td>3</td>
</tr>
<tr>
<td>associate professors</td>
<td>5</td>
</tr>
<tr>
<td>assistant professors</td>
<td>5</td>
</tr>
<tr>
<td>instructors</td>
<td>4</td>
</tr>
<tr>
<td>military</td>
<td>10</td>
</tr>
<tr>
<td>certified neurosurgeons</td>
<td>172</td>
</tr>
<tr>
<td>residents</td>
<td>58</td>
</tr>
<tr>
<td>total</td>
<td>230</td>
</tr>
</tbody>
</table>

* In Greece, neurosurgeons are employed exclusively either in the National Health System or in private practice. Exceptions are academic, military, and state insurance doctors who can work in both sectors.

Type and Distribution of Neurosurgical Units

At the present time, there are 18 neurosurgical units in Greece (in 1970 there were 10). The distribution of the units can be found in Table 2 and Fig. 1. The unit per population ratio is 1:555,555. The total number of neurosurgical beds nationwide is 400 to 450 (1:22,000).

Due to political change, major developments have been observed in the private health sector during the last 6 years. These developments mainly concern the dramatic increase in private diagnostic imaging units (more than 100 computerized tomography and 20 magnetic resonance imaging systems) and the renovation of small (80–120 bed) private general clinics, mainly located in Athens where an already large number of neurosurgeons practice privately. Apart from these small general clinics, there are also two larger private general hospitals in Athens (320 and 250 beds each) where major neurosurgical procedures are performed, including endovascular techniques (for arteriovenous malformations and aneurysms), stereotactic operations, brain endoscopy, and laser procedures. In addition, the establishment of a private gamma knife unit is anticipated.

Neurosurgical Training Units

There are 15 training units (three at university sites), providing a ratio of one training department per 660,000
and one trainee per 175,000 population (Table 3). Training in a medical specialty in Greece is mediated through the Ministry of Health and, therefore, both the hospital authorities and the chief neurosurgeon have no control over trainee employment procedures. The training period in neurosurgery is 6 years, with the first 2 years devoted to general surgery and neurology.

**Qualification and Licensure in Neurosurgery**

In Greece, specialty qualification is strictly controlled by the state. Medical graduates enter a specialty solely by applying. After completing their training, the candidates undergo examinations organized by the Ministry of Health to obtain the licence to practice. Consequently, the Greek neurosurgical community—professors, training unit directors, and the Hellenic Neurosurgical Society, the official scientific organization of neurosurgeons—has no direct control over the training or qualification procedures. Although many proposals to improve this system have been introduced by these groups, none has succeeded in changing the existing policy.

**Table 3**

<table>
<thead>
<tr>
<th>Country</th>
<th>Training Hospitals/Per Population</th>
<th>Residents/Per Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>1:2,700,000*</td>
<td>1:350,000</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>1:1,600,000</td>
<td>1:700,000</td>
</tr>
<tr>
<td>Greece</td>
<td>1:660,000</td>
<td>1:175,000</td>
</tr>
</tbody>
</table>

* Data obtained from *Neurosurgery.*

**Comparisons With International Standards**

According to the European Association of Neurological Surgeons and British standards, one neurosurgical unit per 1,000,000 to 3,000,000 population is the optimum ratio, whereas the desirable ratio of neurosurgeons to the total population is 1:180,000 to 1:500,000. The respective numbers in Greece (1:555,555 and 1:58,000) deviate significantly from the optimum figures (Table 4). The same conclusions can be drawn by comparing Greece with United States and United Kingdom standards, with respect to training units and trainees (Table 3).

**Future Considerations for Neurosurgery in Greece**

Over the next few years a minimum of measures will be required. These could include the following.

1) An immediate reduction in the number of neurosurgical units and establishment of large neurosurgical centers, which will offer all modern means of neurosurgical care and centralization of facilities to increase the exposure of certified neurosurgeons and trainees to clinical experience.

2) A dramatic decrease in the number of residents. The number of trainee posts should be correlated to the number of permanent state jobs. Those individuals training abroad should be required to register so that they will be eligible to apply for permanent jobs.

3) Information campaigns directed toward general practitioners and neurologists about new techniques and methods. This approach should increase referrals for operations to more appropriate levels.

4) Consideration of subspecialization as an immediate measure to combat underemployment and unemployment. The major need for urgent neurosurgical consultation, particularly in state hospitals, is because of head injury (mild or severe). The establishment of a new specialty or subspecialty, perhaps termed “neurotraumatology,” and the development of a neurosurgical network, consisting of “consultant neurotraumatologists” in each hospital, could create 80 new jobs. Each neurotraumatologist would be able to provide emergency treatment and long-term follow-up evaluation for head trauma and spinal injuries. It is...
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important that this should be a defined subspecialty and not viewed as a grouping of “failed neurosurgeons.” The subspecialty should develop its own specific training programs and be able to coordinate specialist trauma care.

Conclusions

In some areas of the world the training of large numbers of young doctors in neurosurgery has led to overproduction of neurosurgeons.¹⁶ This study has focused specifically on neurosurgery in Greece; however, it reflects problems existing in many countries, which should be considered by the international neurosurgical community. The professional dilemma exists elsewhere, including the United States, Japan, and Brazil.³³⁸ Perhaps this contribution will stimulate thought and comment in other countries.

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References


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