

Review Article

Standards for Endovascular Neurosurgical Training and Certification of the Society of Korean Endovascular Neurosurgeons 2013

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Certification Committee of Society of Korean Endovascular Neurosurgeons⁹

The need for standard endovascular neurosurgical (ENS) training programs and certification in Korea cannot be overlooked due to the increasing number of ENS specialists and the expanding ENS field. The Society of Korean Endovascular Neurosurgeons (SKEN) Certification Committee has prepared training programs and certification since 2010, and the first certificates were issued in 2013. A task force team (TFT) was organized in August 2010 to develop training programs and certification. TFT members researched programs and systems in other countries to develop a program that best suited Korea. After 2 years, a rough draft of the ENS training and certification regulations were prepared, and the standard training program title was decided. The SKEN Certification Committee made an official announcement about the certification program in March 2013. The final certification regulations comprised three major parts: certified endovascular neurosurgeons (EN), certified ENS institutions, and certified ENS training institutions. Applications have been evaluated and the results were announced in June 2013 as follows: 126 members received EN certification and 55 hospitals became ENS-certified institutions. The SKEN has established standard ENS training programs together with a certification system, and it is expected that they will advance the field of ENS to enhance public health and safety in Korea.

Key Words : Endovascular Neurosurgery · Certification Committee · Society of Korean Endovascular Neurosurgeons.

INTRODUCTION

Endovascular neurosurgery (ENS), intravascular neurosurgery and interventional neuroradiology have become major treatment modalities for cerebrovascular diseases along with neurosurgical operations. Despite gradual advances in noninvasive neurodiagnostic technology, diagnostic cerebral catheter angiography is still recognized as the gold standard for evaluating cerebrovascular diseases⁴. However, all ENS procedures car-

ry a risk for stroke, indicating that appropriate and acceptable knowledge, procedural training, and case experience are necessary to perform ENS procedures safely. While several other countries have suggested ENS training standards^{1,3,4,7,9,10,14,15,17,19} or have begun ENS certification, no ENS training programs or certification systems have been established in Korea. There are two ENS-associated societies in Korea; The Society of Korean Endovascular Neurosurgeons (SKEN) and the Korean Society of Interventional Neuroradiology. The need for standard ENS

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training programs and certification in Korea cannot be overlooked due to the increasing number of ENS specialists and expanding ENS fields. The SKEN Certification Committee has prepared training programs and certification since 2010, and the first certificates were issued in 2013. The purpose of this study was to introduce training standards and define the minimum training and case experience required for certification.

PREPARATION OF THE TASK FORCE TEAM AND CERTIFICATION COMMITTEE

A task force team (TFT) was organized in August 2010 to develop training programs and certification. TFT members conducted research on programs and systems in other countries^{1-6,8-21)} and conceptualized the programs that would best suit Korea. After 1 year of effort, a rough draft of the ENS training and certification regulations was prepared, and the standard training program title was decided. The certification comprises personal certification, hospital certification, and training-facility certification. The first briefing meeting was arranged for the executive directors of the SKEN in August 2012. The TFT emphasized the need for standard training programs and certification, and it was decided to introduce the training programs and certification. The TFT felt the need for more information on the current ENS situation in Korea before prescribing detailed rules; thus, they conducted a questionnaire survey of all SKEN members. This enabled the TFT to gather informative data such as hospital capacities, case experience, ENS constitution, and disease distributions. Then, detailed rules were discussed based on the survey results and regulations in other countries^{1,3,4,6,9,14,15)}. Much effort was put into designing a program that best suited Korean society, and it took 20 months to complete the final draft. This draft was approved by the executive committee at the second briefing meeting and they resolved to form a Certification Committee. After the meeting, the TFT published a report entitled "Research Results of Korean Neuroendovascular Surgery Standard Training and Certification Program". The first meeting of the Certification Committee was held in November 2012, and detailed plans to introduce ENS certification were discussed. The certification regulations were amended several times in the course of subsequent meetings. The Certification Committee officially announced the certification program in March 2013, and applications for certification were accepted for 8 weeks. The applications were then evaluated for 3 weeks, and the results were announced in June 2013 as follows : 126 ENS members received personal certificates and 55 hospitals received hospital certificates.

THE MAIN ISSUES IN SKEN CERTIFICATION

Some patient-safety issues were discussed among the committee members at the time of developing the certification system : "How can we prove whether SKEN members are capable

of performing endovascular treatment?", "What would be sufficient endovascular procedural experience for trainees?", "Are most endovascular procedures performed under an operative neurosurgical back-up system?"

As the ENS field in Korea has been expanding, the number of ENS specialists has also been increasing. Unfortunately, secure ENS procedures and units could not be guaranteed, as the SKEN did not have standard training protocols or minimal requirements for ENS units. Hence, the Certification Committee included minimum requirements for safe ENS in the regulations and essential structural elements for ENS units. Additionally, the following aspects were considered important : number of ENS cases (associated with operator skill), types of ENS, and presence of an open neurosurgery backup.

Controversy arose among the Certification Committee when the adequate number of ENS cases for certified trainees was to be decided, as standard foreign training programs and certifications did not fit the Korean situation^{1,10,15,18)}. Moreover, the committee did not have a clear picture of the Korean ENS training situation, since ENS training was conducted at each hospital with no common training protocol or certification process. The Certification Committee had several meetings to analyze the foreign systems and conduct a survey. The appropriate number of ENS cases for trainees was established based on these analyses and research.

ENS offers immediate advantages over microscopic neurosurgery, as it is less invasive and provides more rapid recovery for patients. Because the number of neurosurgeons who choose to subspecialize in ENS is increasing, the number of hospitals in which only ENS is available, with no open neurosurgery backup, is also increasing. This allows hospitals to have simpler surgical setups, thereby reducing costs. However, this also means that the number of hospitals at which neurosurgical operations are not available when needed is increasing. Therefore, the committee decided that for patient safety, which is the top priority, certified ENS hospitals should be equipped with a neurointensive care unit and microscopic neurosurgical setup.

The Certification Committee agreed that more stringent rules should be applied to certification of training hospitals because they are operated based on an authorized and reliable ENS training program. Therefore, the committee decided that certified training hospitals should be fully equipped with more facilities, cases, types of diseases, and medical staff than required for certified ENS hospitals. Moreover, evaluation standards for ENS training directors were developed with reference to foreign standards. These criteria were designed to be as practical and clear as those in other countries and to be suitable for Korean society.

STANDARDS OF SKEN ENDOVASCULAR NEUROSURGICAL TRAINING AND CERTIFICATION

Supplement includes document contents (online).

I. Endovascular neurosurgeon

1. Regulations to certify an endovascular neurosurgeon

A. Objective

This regulation includes the requirements for the endovascular neurosurgery qualification process.

B. Definitions

A “certified endovascular neurosurgeon (EN)” is a regular member of the SKEN who has varied experience in the field of endovascular neurosurgery and is qualified and certified by the SKEN to have the ability to conduct special quality medical treatment in the fast-progressing field of endovascular neurosurgery.

C. Qualification process

Training program

- 1) Physicians who want to become EN certified must take the training program at a training hospital designated by the SKEN.
- 2) At least 1 year of training after acquiring qualification for board certification is required to apply for the qualification test.
- 3) The training year is from March 1 to the end of February the following year. If training was started after completing military or alternative service, the training year is from May 1 to the end of February the following year.

D. Qualification process

Applicants for the certified EN qualification must complete the following documents for the Certification Committee. The Certification Committee evaluates the qualifications of the certified EN by judging the application.

- 1) Certified EN application in accordance with the format of accompanying document 1.
- 2) Certified EN training certificate in accordance with the format of accompanying document 3.
- 3) Copy of the board certification license.
- 4) Continuing medical education (CME) record in accordance with the format of accompanying document 5.
- 5) Individual endovascular reports and operative records in accordance with the format of accompanying document 8.
- 6) Individual cerebral angiography reports and records in accordance with the format of accompanying document 9.
- 7) Director’s confirmation of assistance with operations in accordance with the format of accompanying document 4.
- 8) Copies of published articles.

E. Qualification requirements

Participated as a regular member of the SKEN for at least 1 year and fulfills the following requirements :

- 1) At least 150 cases of diagnostic cerebral angiography and at least 80 cases as a first assistant in endovascular neurosur-

gery procedures at a certified training institution.

- 2) At least 40 of the 80 case reports must include the following operations :
 - a. Endovascular treatment of cerebral aneurysms.
 - b. Extracranial and intracranial angioplasty and stenting.
 - c. Intra-arterial thrombolysis.
- 3) At least 10 CME points from training lectures or conferences recognized by the SKEN.
- 4) At least one study authored in the *Journal of Cerebrovascular and Endovascular Neurosurgery* during training.

F. Validity of the qualification

The certified EN’s license is valid for 5 years from the certification date.

2. Recertification

G. Qualification

- 1) At least 5 years have elapsed since the original EN certification and the applicant has acquired 25 CME points from the training and studies designated by the society in the previous 5 years.
- 2) The relevant period is excluded for those who stayed abroad for the purpose of academic research and clinical training. Such persons should submit references in accordance with document 7 to the president of the SKEN.

H. Means of recertification

Recertification is conducted by examining the candidate’s career documents and reporting the results to the president of the SKEN after individual screening by the Certification Committee. The SKEN president renews the certification after inspection by the SKEN executive directorate.

I. Submission

A physician who wishes to be recertified needs to submit an application including the following documents to the committee before the end of the qualification expiration year.

- 1) Copy of the certified EN’s license.
- 2) CME record in accordance with document 5.
- 3) CME report in accordance with document 6.

J. Training education courses

Applicants must have completed the training education courses and complied with the CME and the regulations of the Endovascular Neurosurgery Qualification Process and Training Education.

3. Academic activity and training education

A. Subject

The subject of academic activity and training education is a physician who has acquired the certified EN license or is willing to renew certification.

B. Training education session

The training education session is from March 1 to the end of February the following year.

C. Training education institution

Academic activity and the training education institution should be relevant to :

- 1) The SKEN.
- 2) Other authorized society or affiliated local society.
- 3) Foreign society in the field of endovascular neurosurgery.
- 4) Foreign training education in the field of endovascular neurosurgery.

D. CME points

- 1) Points are received by participating in training education, domestic and foreign conferences, and practice and presentation at conferences. The points for each are provided below.
 - a. The annual SKEN conference is 3 points.
 - b. Conference of another authorized society is 3 points.
 - c. Conference of a foreign endovascular neurosurgery-related society is 2 points.
 - d. Conference of an affiliated local society or affiliated study group is 1 point.
- 2) Submit a copy of the CME record cards, documentation and evidence of participation at the conference, and submit an attendance card for participation in a study group. Presenters and researchers at the society's regular conference receive an additional 1 point. If a thesis is published in a journal, the author receives an additional 1 point.
- 3) Applicants can be exempted from acquisition of CME points by society consent if in the middle of a foreign stay longer than 6 months. The society can deliberate on other causes for CME exemption. Only authorized domestic and foreign conferences are eligible.

4. Special regulations for the first certified endovascular neurosurgeons

A. Objective

This is a temporary and restrictive regulation to certify regular members of the SKEN as certified ENs before undergoing the endovascular neurosurgery qualification process.

B. Definition

The "Special regulations of the first certified endovascular neurosurgeons (special regulations)" are the first regulations to certify ENs and are intended to certify regular members of the SKEN who fulfill the qualifications required for certified ENs as authorized by the SKEN.

C. Subjects

- 1) Physicians who have completed a training process equivalent to the certified EN training program before March

2013, and who joined the SKEN before applying for their first EN certification.

- 2) Physicians who are not subject to special regulations based on the second EN certification.

D. Qualification process

- 1) Qualification process
 - a. Certified EN application following the format of accompanying document 1.
 - b. Copy of the board certification license.
 - c. Individual endovascular reports and operative records in accordance with the format of accompanying document 8.
 - d. Individual cerebral angiography reports and surgical records in accordance with the format of accompanying document 9.
 - e. Research thesis and results that prove research experience related to endovascular neurosurgery.
 - f. Abstract of an academic presentation related to endovascular neurosurgery.
 - g. The Endovascular Neurosurgery Certification Committee may require operative records or procedural records and conduct an actual inspection of the applicant's hospital, if necessary.

E. Qualification requirements

Participated as a full member of the SKEN and fulfills the following requirements :

- 1) At least 150 cases of diagnostic cerebral angiography and at least 80 cases of first assistance in endovascular neurosurgery experience from a training institution.
- 2) At least 40 of the 80 case reports must include the following operations :
 - a. Endovascular treatment of cerebral aneurysms.
 - b. Extracranial and intracranial angioplasty and stenting.
 - c. Intra-arterial thrombolysis.
- 3) Those who make a proactive effort for qualitative improvement in the academic field.
- 4) Physician with a recognized endovascular neurosurgery career.

F. Validity of the qualification

- 1) The certified EN license is valid for 5 years from the certification date.
- 2) Certified physician qualification must be renewed every 5 years. Specific regulations regarding renewal will be provided separately.

II. Endovascular neurosurgery institution

1. Regulations for a certified endovascular neurosurgery institution

A. Definitions

A "certified endovascular neurosurgery institution (certified

institution)”) is an institution that conducts endovascular neurosurgery and meets the SKEN requirements showing that it has the ability to conduct high-quality medical treatment in the rapidly progressing field of endovascular neurosurgery.

B. Qualification requirements

The followings are the requirements for qualification as a certified institution. The Certification Committee may conduct a field investigation of the applying institution, if needed.

- 1) A certified institution should be a superior general hospital or general hospital that is approved by the Certification Committee, and have neurosurgery specialists who specialize in cerebrovascular disease and certified ENs. It must have performance abilities, facilities, and personnel that are approved by the SKEN.
- 2) Facilities and equipment
 - a. At least one angiography room and angiography equipment must be installed.
 - b. Must be capable of open cerebrovascular surgery and have an intensive care unit to treat cerebrovascular patients.
- 3) Personnel
 - a. At least one certified EN.
 - b. At least one neurosurgery specialist capable of open cerebrovascular surgery.
 - c. At least one radiological technician and nurse in all angiography rooms.
- 4) Performance

Conduct at least 40 cases of endovascular neurosurgery per year (The number of operations can be adjusted at the discretion of the Certification Committee and with approval by the SKEN executive directorate).
- 5) Education
 - a. Must conduct a specialized endovascular neurosurgery education program, periodic evaluations, and education in preparation for emergencies.
 - b. Radiological technicians and nurses are limited to those who completed their education from the SKEN or other related society.

C. Institution certification process

Applicants for certified institution qualification and recertification should complete the following documents for the Certification Committee. The Certification Committee evaluates the qualifications of the institution by judging the application.

- 1) Institutional certification (recertification) application in accordance with document 2.
- 2) Angiography room facilities and equipment certificate in accordance with document 12.
- 3) Endovascular neurosurgery staff list and other related references listed below.
- 4) Report of the number of open cerebrovascular surgery cases during the year prior to the certified institution applica-

Table 1. Requirements for institution certification

Classification	Reference
Certified EN	Affiliated hospital's original copy of employment Copy of the board certificate's license Copy of the certified EN license
Neurosurgery specialist	Affiliated hospital's original copy of employment Copy of the board certificate's license
Nurse and radiological technician	Affiliated hospital's original copy of the employment certificate and copy of the 1-year educational qualification prior to the certified institution application

tion, in accordance with document 10.

- 5) Report of the number of endovascular neurosurgery cases during the year prior to the certified institution application, in accordance with document 11.

D. Validity of the qualification

- 1) The certification is valid for 5 years from the certification date.
- 2) The institutional certification must be renewed every 5 years. Specific regulations regarding renewal will be provided separately.

2. Recertification

A. Subject of recertification

At least 5 years must have elapsed since being certified as an endovascular neurosurgery institution (certified institution).

B. Qualification requirements

- 1) Facilities and equipment

Same as regulation II-1-B-2)
- 2) Personnel

Same as regulation II-1-B-3)
- 3) Performance
 - a. Conduct at least 40 cases of endovascular neurosurgery in total per year of education.
 - b. Same as regulation II-1-B-4)

C. Institution certification process

Applicants for institution recertification should complete the following documents for the Certification Committee. The Certification Committee evaluates the qualifications of the certified institution using the documents provided.

- 1) Same as regulation I-1-C-1), 2), 3)
- 2) Report of the number of open cerebrovascular surgery operations during the 5 years after certification, in accordance with document 10.
- 3) Report of the number of endovascular neurosurgery cases during the 5 years after certification, in accordance with document 11.

III. Endovascular neurosurgery training institution

1. Regulations for certified endovascular neurosurgery training institutions

A. Objective

This regulation is intended to regulate the requirements for the certified endovascular neurosurgery training institution qualification process.

B. Definitions

A "Certified endovascular neurosurgery training institution (training institution)" is an institution that conducts endovascular neurosurgery and is certified by the SKEN to have the ability to educate certified ENs to conduct high-quality specialist medical treatment in endovascular neurosurgery.

C. Qualification requirements

The following are the requirements for qualification as a training institution. The Certification Committee may conduct a field investigation of the institution, if necessary.

- 1) The training institution should be a subspecialty training hospital approved by the Minister of Health and Welfare of Korea and have a director who is approved by the SKEN. It must have facilities and personnel approved by the society.
- 2) Facilities and equipment
 - a. At least one angiography room with angiography equipment must be installed. This equipment must provide digital subtraction angiography capable of high-resolution roadmap, biplane, and three-dimensional functions.
 - b. Must be capable of open cerebrovascular surgery with an intensive care unit suitable for treating patients with cerebrovascular disease.
 - c. Must have high-quality computed tomography and magnetic resonance imaging equipment.
 - d. Must have ultrasound in the angiography room that can be used at any time.
 - e. Must have equipment for emergency resuscitation, which must be in the angiography room.
 - f. Must have patient-monitoring devices and a room capable of general anesthesia. Additionally, general anesthesia should be provided in an angiography room.
- 3) Personnel
 - a. At least one endovascular neurosurgery training director (director). The ratio of trainers to trainees should not exceed 1:2.
 - b. Must have a neurosurgery specialist capable of open cerebrovascular surgery.
 - c. At least one radiological technician and one nurse in all angiography rooms.
- 4) Endovascular neurosurgery training director
 - a. Director formulates and maintains the education program for residents and fellows and is responsible for

their education and supervision.

- b. Director provides research conditions for the trainees and secures research facilities. Additionally, the director plans training time, guides research work, and provides technical support.
- c. Director's qualifications
 - i. The director's qualifications are checked once per year. The specific date is announced 3 months beforehand by the SKEN president.
 - ii. Must have at least 5 years of work experience in the endovascular neurosurgery field, and at least 3 years' participation as a regular member of the SKEN.
 - iii. Specialist must actively engage in the performance of endovascular neurosurgery and at least 50% of their practical work must be related to endovascular neurosurgery in the affiliated hospital.
 - iv. Experience of at least 200 cases of endovascular neurosurgery.

[Minimum standard]

- a) Thirty cerebral aneurysm embolization cases.
- b) Five cases of cerebral arteriovenous malformation embolization (including arteriovenous malformation, arteriovenous fistula, and dural arteriovenous fistula).
- c) Twenty cases of extra-intracranial angioplasty and stenting.
- d) Twenty intra-arterial thrombolysis cases.
- e) Five tumor embolization cases.
 - v. Must have delivered at least 10 oral presentations at a domestic or foreign endovascular neurosurgery conference and have published at least three papers in a SCI(E)-level journal.
 - vi. Director-to-trainee ratio should be less than 1:2.
 - vii. Director qualifications are valid for 5 years from the date of certification.
 - viii. Director must be recertified every 5 years. Recertification is decided by the Certification Committee with the approval of the SKEN executive directorate.
- 5) Performance
 - a. Must conduct at least 80 cases of endovascular neurosurgery per year.
 - b. At least 40 of the 80 cases should include the following:
 - i. Cerebral aneurysm embolization.
 - ii. Extra- and intra-cranial angioplasty and stenting.
 - iii. Intra-arterial thrombolysis.
- 6) Education
 - a. Must conduct a specialized endovascular neurosurgery education program and periodic evaluation and education in preparing for an emergency.
 - b. Radiological technicians and nurses fulfilling the personnel requirement specified in clause 4 are limited to those who completed their education in the SKEN or other related society.

D. Institution certification process

Applicants for training institution qualification and recertifi-

cation should complete the following documents for the Certification Committee. The Certification Committee evaluates the qualifications of the training institution using the documents provided.

- 1) Training institution certification (recertification) application in accordance with document 2.
- 2) Angiography room facilities and equipment possession certificate in accordance with document 12 (Table 2).
- 3) Certified EN list and other related references listed below.
- 4) Report of the number of open cerebrovascular surgery cases treated during the year prior to application for institution certification, in accordance with document 10.
- 5) Report of the number of endovascular neurosurgery cases treated during the year prior to application for institution certification, in accordance with document 11.

E. Validity of the qualification

The training institution qualification is valid for 5 years from the certification date.

2. Recertification

A. Subject of the recertification

If at least 5 years have passed since the institution was certified as an endovascular neurosurgery training institution (training institution), recertification is required.

- 1) Facilities and equipment
Same as regulation III-1-C-2)
- 2) Personnel
Same as regulation III-1-C-3)
- 3) Performance and verification
Must have conducted at least 80 cases of endovascular neurosurgery annually during the previous 5 years.
- 4) Education
Same as regulation III-1-C-6)

B. Submission

Applicants for training institution recertification must complete the following documents for the Certification Committee in accordance with document 2. The Certification Committee evaluates the training institution qualifications using the documents provided.

- 1) Same as regulation III-1-D-1), 2), 3)
- 2) Report of the number of open cerebrovascular surgery cases treated during the 5 years since the certified institution application, in accordance with document 10.
- 3) Report of the number of endovascular neurosurgery cases treated during the 5 years since the certified institution application, in accordance with document 11.

CONCLUSION

ENS has become a prevalent subspecialty field within neuro-

Table 2. Requirements for training institution certification

Classification	Reference
Director	Affiliated hospital's original copy of employment certificate Copy of the board certificate's license
Neurosurgery specialist	Affiliated hospital's original copy of employment certificate Copy of the board certificate's license
Nurse and radiological technician	Affiliated hospital's original copy of employment certificate and copy of the 1-year educational qualification prior to the certified institution application.

surgery; therefore, an authorized and reliable certification system for ENS in Korea was needed. The SKEN has established standard ENS training programs and a certification system; these are expected to advance ENS and so enhance public health and safety.

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References

1. American Society of Interventional and Therapeutic Neuroradiology : General considerations for endovascular surgical neuroradiologic procedures. *AJNR Am J Neuroradiol* 22 (8 suppl) : s1-s3, 2001
2. Byrne JV : Training of neurointerventional therapists. *Neuroradiology* 50 : 203-204, 2008
3. Choi IS, Lasjaunias P, Picard L : Standards of Practice in Interventional Neuroradiology or Endovascular Neurosurgery. WFITN Site Conditions and Technical Operational Guidelines. *Interv Neuroradiol* 12 : 7-8, 2006
4. Connors JJ 3rd, Sacks D, Furlan AJ, Selman WR, Russell EJ, Stieg PE, et al. : Training, competency, and credentialing standards for diagnostic cervicocerebral angiography, carotid stenting, and cerebrovascular intervention. *AJNR Am J Neuroradiol* 25 : 1732-1741, 2004
5. Fiorella D, Hirsch JA, Woo HH, Rasmussen PA, Shazam Hussain M, Hui FK, et al. : Should neurointerventional fellowship training be suspended indefinitely? *J Neurointerv Surg* 4 : 315-318, 2012
6. Harbaugh RE, Agarwal A : Training residents in endovascular neurosurgery. *Neurosurgery* 59 (5 suppl 3) : s277-s281; discussion s3-s13, 2006
7. Higashida RT, Hopkins LN, Berenstein A, Halbach VV, Kerber C : Program requirements for residency/fellowship education in neuroendovascular surgery/interventional neuroradiology : a special report on graduate medical education. *AJNR Am J Neuroradiol* 21 : 1153-1159, 2000
8. Hopkins LN, Higashida RT, Piepgras DG : Perspectives on training standards in neuroendovascular therapeutics. *Neurosurg Clin N Am* 11 : 187-190, 2000
9. Howington JU, Hopkins LN, Piepgras DG, Harbaugh RE : Training standards in endovascular neurosurgery. *Neurosurg Clin N Am* 16 : 445-449, 2005
10. Hyogo T, Taki W, Negoro M, Takahashi A, Edura M, Hyodo A, et al. : Japanese society of neuro-endovascular treatment specialist qualifica-

- tion system. Six years' experience and introduction of an animal model examination. *Interv Neuroradiol* 14 : 235-240, 2008
11. Johnson CM, Hodgson KJ : Advanced endovascular training for vascular residents : what more do we need? *Semin Vasc Surg* 19 : 194-199, 2006
 12. Meyers PM, Blackham KA, Abruzzo TA, Gandhi CD, Higashida RT, Hirsch JA, et al. : Society of NeuroInterventional Surgery Standards of Practice : general considerations. *J Neurointerv Surg* 4 : 11-15, 2012
 13. Miguel K, Hirsch JA, Sheridan RM : Team training : a safer future for neurointerventional practice. *J Neurointerv Surg* 3 : 285-287, 2011
 14. Miyachi S, Okamoto T, Kobayashi N, Kojima T, Hattori KI, Nakai K, et al. : Nagoya university training system for neuroendovascular therapists. *Interv Neuroradiol* 10 Suppl 1 : 103-106, 2004
 15. Picard L, Negoro M, Ter Brugge K, Mawad M, Lasjaunias P, Viñuela F, et al. : 1998 world Federation of interventional and therapeutic neuroradiology. Guidelines for fellowship training programmes in interventional neuroradiology. *Interv Neuroradiol* 4 : 195-197, 1998
 16. Qureshi AI, Abou-Chebl A, Jovin TG : Qualification requirements for performing neurointerventional procedures : a Report of the Practice Guidelines Committee of the American Society of Neuroimaging and the Society of Vascular and Interventional Neurology. *J Neuroimaging* 18 : 433-447, 2008
 17. Richling B, Lasjaunias P, Byrne J, Lindsay KW, Matgé G, Trojanowski T : Standards of training in endovascular neurointerventional therapy : as approved by the ESNR, EBNR, UEMS Section of Neurosurgery and EANS (February 2007). Enclosed the standards of practice as endorsed by the WFITN. *Acta Neurochir (Wien)* 149 : 613-616; discussion 616, 2007
 18. Roh HG : Perspectives on fellowship training standard in interventional neuroradiology. *Neurointervention* 2 : 13-16, 2007
 19. Taki W, Gotoh K, Hyodo A, Hyogo T, Kinugasa K, Koike T, et al. : Editorial : The First Specialist Qualification Examination of the Japanese Society of Intravascular Neurosurgery (JSIN). *Interv Neuroradiol* 8 : 343-345, 2002
 20. Writing Group for the American Academy of Neurology, AANS/CNS Cerebrovascular Section, Society of NeuroInterventional Surgery, the Society of Vascular & Interventional Neurology, Meyers PM, Schumacher HC, et al. : Performance and training standards for endovascular ischemic stroke treatment. *J Neurointerv Surg* 1 : 10-12, 2009
 21. Zaidat OO : The stroke and neurovascular program at the medical college of wisconsin and froedtert hospital. *J Vasc Interv Neurol* 1 : 27-30, 2008

SUPPLEMENTARY MATERIALS

Document 1. Certified endovascular neurosurgeon application form

Application	<input type="checkbox"/> New <input type="checkbox"/> Recertification		Certified No.	*(Recertification only)
	Name		Citizen registration number	-
	Physician license number		Specialist board license number	
	Affiliated hospital		Position	
	Phone number		Fax	
	Mobile phone number		E-mail	

*Do not omit any field, and all fields should correspond to your attached documents

Trainee information	Membership	Regular member of the Society of Korean Endovascular Neurosurgeons	<input type="checkbox"/> Yes / <input type="checkbox"/> No
		Acquisition of specialist medical board	<input type="checkbox"/> Yes / <input type="checkbox"/> No
	Training results and verification	Cases participated in as operator during training period (new regulation only)	Cases
		Cases participated in as first assistant during training period (new regulation only)	Cases
		Number of articles published in the Journal of Cerebrovascular and Endovascular Neurosurgery during the training period?	article(s)
CME	CME points during the training period	Points	

***Attached documents**

1. Copy of the specialist board certification license.
2. Training certification (document 3).
3. Individual endovascular reports and operative records (document 8).
4. Director's confirmation of assists with operations (document 4).
5. Copies of published articles.
6. CME (document 5).

To the chairman of Society of Korean Endovascular Neurosurgeons.

I agree with the regulations for certified endovascular neurosurgeons and request examination as a certified endovascular neurosurgeon.

201 . . .

Signature :

Deliberations	Certification committee	Date		The person in charge	
	Executive directorate	Date		The person in charge	
	Others				

Document 2. Certified (Institution, Training institution) application form

Application	<input type="checkbox"/> New <input type="checkbox"/> Recertification		Certified number	*(Recertification only)
Information of institution	Name of hospital		The person in charge	
	Address	Zip code:		
Personnel information (Certified endovascular neurosurgeon or training director)	Name	(Korean)	(English)	
	Specialty		Position	
	Phone number		Fax.	
	Mobile phone		E-mail	

※ All fields must be completed and accord with your attached documents

Institutional information	Existence of facilities and equipment	Angiography room	<input type="checkbox"/> Yes / <input type="checkbox"/> No	Room(s)	
		Angiographic machine	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)	
		Intensive care unit	<input type="checkbox"/> Yes / <input type="checkbox"/> No	Bed(s)	
		Ultrasound machine	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)	
		Patient monitors and emergency kit	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)	
		CT and MRI	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)	
		General anesthesia in the angiography room	<input type="checkbox"/> Can / <input type="checkbox"/> Cannot		
	Personnel information	Certified endovascular neurosurgeon			Person(s)
		Endovascular neurosurgery training director			Person(s)
		Neurosurgery specialist capable of open cerebrovascular surgery			Person(s)
		Other physicians or resident physicians			Person(s)
		Radiological nurses in angiography room			Person(s)
		Radiological technicians in angiography room			Person(s)
Procedures	Total number of institutional endovascular neurosurgery operations in the LAST YEAR			Procedure(s)	

※ Attached documents

1. Angiography room facilities and equipment possession certificate (document 12).
2. Affiliated hospital's original copy of employment certificate (certified endovascular neurosurgeon, training director, neurosurgery specialist, radiological nurse, and radiological technician).
3. Copy of the 1-year educational qualification (radiologic nurse, radiologic technician).
4. Report of endovascular neurosurgery and open cerebrovascular neurosurgery procedures performed at the institution (documents 10 and 11).

To the chairman of the Society of Korean Endovascular Neurosurgeons,
I agree with the regulations for certified endovascular neurosurgery institutions (training institutions) and request examination as a certified endovascular neurosurgery institution (training institution)

201 . .
Signature : (person in charge)

Deliberations	Certification committee	Date		The person in charge	
	Executive directorate	Date		The person in charge	
	Others				

Document 3

No.

Endovascular neurosurgery training certification

NAME :

Date of birth :

Physician license no. :

Specialist board (no.) : ()

Training period : 201 . . . ~ 201 . . .

This is to certify that this physician completed the endovascular neurosurgery training course at our institution.

201 . . .

Training institution :

Training director : (Signatures)

Director of institute : (Signatures)

Document 4

No.

Director's confirmation of assistance with operations

NAME		Citizen registration number	-
Physician license number		Specialist board (Number)	()
Affiliated hospital			
Total number of endovascular neurosurgery cases			
Number of assists with operations			
Training director		Telephone number	

We confirm that this physician participated in endovascular neurosurgery as an assistant.

201 . .

Training institution :

Training director : (Signature)

Director of institution : (Signature)

Document 5

Continuing medical education

NAME : _____ (signature)

Endovascular neurosurgeon certification no. : _____

Physician license no. : _____

Specialty board license (no.) : _____ ()

1) Study, training and practice

Date	Title	Location	Sponsorship	Points
Total points				

2) Conferences and symposia

Date	Title	Location	Sponsorship	Points
Total points				

3) Articles

Author	Title	Classification	Journal	Points
Total points				

- Describe co- or corresponding authors together; e.g., Hong Gil Dong with two workers (Correspond).
- Describe the original paper, review, or case report in the classification panel.
- Include CME report [document 6] and copies of articles.

Document 6

No.:

Continuing medical education report

NAME : _____

Date of birth : _____

Physician license number : _____

Specialty board license (number) : _____ (_____)

Endovascular neurosurgery certification number (Recertification only) : _____

CME points:	Total	Points

	Study, training, and practice	_____ Points
	Conference and symposium	_____ Points
	Articles	_____ Points

Period : 201 . . . ~ 201 . . .

This physician has acquired the CME points described above.

201 . . .

Chairman of the Society of Korean Endovascular Neurosurgeons

Document 7

Long-term overseas stay report (RECERTIFICATION ONLY)

NAME	(Korean)	(English)	
Physician license number		Citizen registration Number	
Specialty board (number)	()	Year of certification	
Number of endovascular neurosurgeons certified			
Affiliated hospital		Position	
Telephone number		e-mail	

Reason for long-term overseas stay

Period	Country	Purpose	Remarks

To the chairman of the Society of Korean Endovascular Neurosurgeons,

I am applying for endovascular neurosurgeon recertification and report a long-term overseas stay, see the attached document.
If I have provided false information, I accept revocation of certification.

201 . .

NAME : (signature)

* Attach document proving your long-term overseas stay.

Individual endovascular report

	Patient name	Patient no.	Age	Gender	Sort*	Date	Diagnosis	Procedures
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

To the chairman of the Society of Korean Endovascular Neurosurgeons,

I present this report for certification. If I have provided false information, I accept revocation of certification.

20 . .

NAME : (signature)

1. State "first assist" or "operator" in the 'Sort' column.
2. Date : yyyy-mm-dd (e.g., 2011-01-12)
3. Use accepted abbreviations (e.g., MCA, ACA, PCA, acom, pcom, VA, BA, UIA, ICH, IVH, SAH).
4. Do not describe side (right or left) or size. Describe only location and pathology (e.g., MCA UIA, Pcom ruptured aneurysm, vertebral artery dissection).
5. Do not describe operative approach. Describe only operative method (e.g., coil embolization, glue embolization, PVA embolization, Onyx embolization, chemical angioplasty, mechanical angioplasty, intra-arterial thrombolysis, carotid artery stenting).

Cerebral angiography report

	Patient name	Patient no.	Age	Gender	Date	Diagnosis	Remarks
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

To the chairman of the Society of Korean Endovascular Neurosurgeons,

I present this report for certification. If I have provided false information, I accept revocation of certification.

20 . .

NAME : (signature)

1. Date : yyyy-mm-dd (e.g., 2011-01-12)
2. Use accepted abbreviations (e.g., MCA, ACA, PCA, acom, pcom, VA, BA, UIA, ICH, IVH, SAH).
3. Do not describe side (right or left) or size. Describe only location and pathology (e.g., MCA UIA, Pcom ruptured aneurysm, vertebral artery dissection).

Report of open cerebrovascular neurosurgery at the institution

	Patient name	Patient no.	Age	Gender	Date	Diagnosis	Operations
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

To the chairman of the Society of Korean Endovascular Neurosurgeons,

I present this report for certification. If I have provided false information, I accept revocation of certification.

20 . .

NAME : (signature)

1. Date : yyyy-mm-dd (e.g., 2011-01-12)
2. Use accepted abbreviations (e.g., MCA, ACA, PCA, acom, pcom, VA, BA, UIA, ICH, IVH, SAH).
3. Do not describe side (right or left) or size. Describe only location and pathology (e.g., MCA UIA, Pcom ruptured aneurysm, vertebral artery dissection).
4. Do not describe operative approach. Describe only operative method (e.g., aneurysm neck clipping, hematoma removal, AVM excision).

Report of endovascular neurosurgery at the institution

	Patient name	Patient no.	Age	Gender	Date	Diagnosis	Procedures
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

To the chairman of the Society of Korean Endovascular Neurosurgeons,

I present this report for certification. If I have provided false information, I accept revocation of certification.

20 . .

NAME : (signature)

1. Date : yyyy-mm-dd (e.g., 2011-01-12)
2. Use accepted abbreviations (e.g., MCA, ACA, PCA, acom, pcom, VA, BA, UIA, ICH, IVH, SAH).
3. Do not describe side (right or left) or size. Describe only location and pathology (e.g., MCA UIA, Pcom ruptured aneurysm, vertebral artery dissection).
4. Do not describe operative approach. Describe only operative method (e.g., coil embolization, glue embolization, PVA embolization, Onyx embolization, chemical angioplasty, mechanical angioplasty, intra-arterial thrombolysis, carotid artery stenting).

Document 12

No. :

Angiography room facilities and equipment certificate

Institution : _____

Institution No : _____

Address : _____

Angiography room	<input type="checkbox"/> Yes / <input type="checkbox"/> No	Room(s)
Angiographic machine	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)
Intensive care unit	<input type="checkbox"/> Yes / <input type="checkbox"/> No	Bed(s)
Ultrasound machine	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)
Patient monitors and emergency kit	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)
CT and MRI	<input type="checkbox"/> Yes / <input type="checkbox"/> No	(Model)
General anesthesia in the angiography room	<input type="checkbox"/> Can / <input type="checkbox"/> Cannot	

To the chairman of the Society of Korean Endovascular Neurosurgeons,

Our hospital possess the above facilities and equipment. If I have provided false information, I accept revocation of certification.

201 . . .

Certified endovascular neurosurgeon (or training director) :

Hospital director :

*Attach a plan view of the angiography room or photographs.

*Requires the official seal of the hospital.