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제11회 대한뇌종양학회 동계학술대회 및 연수강좌

일시_ 2017. 2. 3(금) ~ 4(토)

장소_ 무주덕유산리조트



대한뇌종양학회

주관 : 대한신경외과학연구재단

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2월 3일(금) 카니발컬처텔리스 B1, 양상블홀

12:30-13:20	Registration	
13:20-13:30	Opening Remark	이선일 (대한뇌종양학회 회장)
13:30-15:50	Symposium I : Basics in the neurosurgical field	
13:30-14:30	Part I -----	좌장: 이상원 (성빈센트병원), 이창훈 (한국뇌자력의학원)
13:30-13:50	Surgical preparation and drape for preventing surgical site infection	장우열 (화순전남대병원) • 6
13:50-14:10	Basic surgical technique and positioning	이승환 (강동경희대병원) • 8
14:10-14:30	Proper using of surgical instruments	홍제범 (분당제생병원) • 9
14:30-14:50	Coffee Break	
14:50-15:50	Part II -----	좌장: 조경기 (분당차병원), 김태영 (원광대병원)
14:50-15:10	Management of dural defect and CSF leak	양승호 (성빈센트병원) • 14
15:10-15:30	Various bleeding control during surgery	홍창기 (강남세브란스병원) • 15
15:30-15:50	Management of brain edema during surgery	송영진 (동아대병원) • 16
15:50-16:10	Coffee Break	
16:10-18:00	Symposium II: New era in diagnosis and treatment of malignant gliomas according to the new WHO classification	
	-----	좌장: 고영초 (건국대병원), 홍용길 (서울성모병원)
16:10-16:40	What's update on the new WHO classification of CNS malignant gliomas	이경화 (화순전남대병원 병리과) • 20
16:40-17:00	Treatment strategy for malignant gliomas according to the new WHO classification	김재용 (분당서울대병원) • 22
17:00-17:20	Immunotherapy as a cutting edge treatment in malignant gliomas	김세현 (분당서울대병원 혈액종양내과) • 25
17:20-17:40	Current and future of targeted therapy for malignant gliomas	강신혁 (고려대안암병원) • 28
17:40-18:00	Surgical tactics of Insular and eloquent area gliomas	박철기 (서울대병원) • 29
18:00	Closing Remark	
18:30-21:00	Dinner	

2월 4일(토) 호텔티롤 B2, 질레탈룸

08:30-09:10	Breakfast Seminar -----	좌장: 김충현 (한양대구리병원)
	Phase III randomized trial of autologous cytokine-induced killer cell immunotherapy for newly diagnosed glioblastoma in Korea	공두식 (삼성서울병원) • 32
09:10-09:30	Review of 2016 ASNO meeting -----	좌장: 김오룡 (영남대병원)
09:10-09:20		조진모 (국제성모병원) • 36
09:20-09:30		노태훈 (아주대병원) • 37
09:30-09:40	Coffee Break	
09:40-11:00	Scientific Session -----	좌장: 김영규 (충북대병원), 정진 (화순전남대병원) • 40
11:00-11:10	경품 추첨	
11:10	Closing Remark	

발표자 준수사항

1. 구연 발표의 시간을 엄수해 주십시오. 발표시간은 토론시간을 포함하여 10분 (7분 발표, 3분 토론)입니다.
2. 사전에(최소한 발표 1시간 이전에 회의장으로) 발표하실 자료를 제출바랍니다.
3. Computer projection은 single projection만 가능합니다.

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1. 시간을 엄격히 지켜 주십시오.
2. 한두 사람에 의해 토론이 독점되지 않도록 진행하여 주십시오
3. 토론이 없을 경우를 대비하여 좋은 토론 내용을 미리 준비하시기 바랍니다.
4. 주제를 벗어난 부적절한 발언이나 토론 내용은 즉시 제지하여 주시기 바랍니다.

Symposium I : Basics in the neurosurgical field

Part I

좌장: 이상원 (성빈센트병원), 이창훈 (한국원자력의학원)

Surgical preparation and drape for preventing surgical site infection

장우열 (화순전남대병원)

Basic surgical technique and positioning

이승환 (강동경희대병원)

Proper using of surgical instruments

홍제범 (분당제생병원)

Surgical preparation and drape for preventing surgical site infection

Woo Youl Jang,

Tae-Young Jung, Kyung-Sub Moon, In-Young Kim, Shin Jung

Brain Tumor Clinic & Gamma Knife Center, Department of Neurosurgery, Chonnam National University
Hwasun Hospital & Medical School

Surgical site infection (SSI) affect 1.4% of patients in neurosurgery. It adversely effects patient quality of life, length of hospital stay and cost of care. The prevention of SSI can be classified into the preoperative, intraoperative, and postoperative phase. The preoperative phase includes diabetes control, shorter hospital stay before surgery, etc. Techniques for prevention of SSI during the operation commonly include the use of a clean room, appropriate antibiotics use, and maintenance of clean surgical fields. Finally, good nutrition and proper wound care are important factors in postoperative prevention of SSI.

Hair shaving still remain on-going debate in cranial surgery. There is a worldwide belief that hair in the surgical site will decrease the sterility of surgery and increase the risk of SSI by interfering with exposure of the incision. Therefore, many neurosurgeons preferred hair shaving before cranial surgery as a part of preoperative preparation. However, there are also some studies that hair is not a risk factor for the development of SSI. They suggest no hair shaving or strip type shaving. We review the effects of hair shaving on body image and SSI.

Preoperative skin preparation includes preadmission/in-ward antiseptic skin cleansing and antiseptic skin preparation in operating room. Effective preoperative antiseptics is considered a key element in prevent SSI. The most commonly used antiseptic agents are chlorhexidine (CHG) and povidone-iodine (PVI). There are variable methods for sterile preoperative skin preparation. We review some different preadmission/in-ward antiseptic skin cleaning protocol and commonly used methods of preoperative skin preparation in operating room in focus of antiseptic effect compared to each other.

The use of adhesive drapes is an option to immobilize the skin resident bacterial flora that persists after application of antiseptic skin preparation. Especially, Iodine-impregnated drape has aided in decreasing contamination of surgical field. Inherently, it may decrease

SSI by decreasing the amount of bacteria that may become impregnated during surgery. We review the sterile surgical adhesive drape including IO-ban and discuss the effectiveness to prevent SSI.

Surgical site infection by decreasing the amount of bacteria that may become impregnated during surgery. We review the sterile surgical adhesive drape including IO-ban and discuss the effectiveness to prevent SSI.

Basic surgical technique and positioning

Seung Hwan Lee

Department of Neurosurgery, Kyung Hee University Hospital at Gangdong

It has been said that the most important part of a surgical procedure occurs before the skin incision, and much of the ease or difficulty of the intracranial procedure is determined by patient positioning. Optimal positioning allows the surgical team to complete their goals in the most effective fashion in many ways. In addition, to the beginners, the basic surgical technique also important in preventing unexpected complications on every steps in procedure. Herein, the presenter would prepare the basic surgical technique from skin incision to craniotomy, and various optimal surgical positions in each relevant intracranial lesions on the basis of the tradition and experience of presenter's institution.

Proper using of surgical instruments

Je Beom Hong

Department of Neurosurgery, Bundang Jesaeng General Hospital

The introduction of modern surgical instruments for brain tumor surgery brought about the great improvements in operative technique and surgical outcome. We will review many instruments required to brain tumor surgery and their proper using.

1. Operating Microscope

The operating microscope is one of the most important instruments in modern brain tumor surgery. Improved visual acuity improved the technical completeness of the surgery and operative results. Microsurgical techniques, which require the use of the operating microscope, are a key part of tumor surgery and the acquisition of skill and proficiency in the use of the mobile operating microscope is the first step in microsurgery.

2. Operating Chair, Operating Table, Instrument Table

A good operating chair is an important piece of equipment, although some neurosurgeons prefer to operate standing.

The operating table should be lowered to 40 cm above the floor, and thus allows surgeon to keep the patient's head higher than his heart in various operating positions such as the lateral, Concorde and sitting, while at the same time keeping his head at a suitable height in relation to the surgeon.

The importance of the instrument table has not been stressed in the past. It would seem to be a matter of more concern to the scrub nurse than to the surgeon. However, it is clear that an instrument table that over-rides the operating table is more convenient than one placed at its side.

3. Neuronavigation System

Orientation is one of the most important factors in neurological surgery. Without proper orientation, the surgeon will waste time and sometimes do unnecessary harm to the brain. The rapid development of computer assisted diagnostic imaging including CT, MRI, and angiography, has led to a great improvement in the diagnostic ability of neurosurgeons.

These image data provide a neurosurgeon with accurate coordinates and size of a lesion and even a functional area mapping of individual cases. Some systems (image guided surgery systems or neuronavigators) correlate these data directly into the operating field.

4. High-Speed Microdrill

Craniotomy is one of the critical parts of the operation in that the surgeon is very much dependent on correct and reliable instrument function.

High-speed low-profile drills, either electric or pneumatic, may be very helpful for opening the bony structures to gain access to the dural space. A drill with forward and reverse rotation is preferred. The use of the drill should be planned so that the burr rotates away from critical structures. Only diamond burrs are used near important structures. Also, various perforators and craniotomes are available.

5. Endoscope

The endoscope permits access to deep anatomic structures in a minimally invasive manner. It allows the visualization of deep, hidden structures in the brain and transmits clear and usable images to the surgeon. Its main characteristic and advantage is that it brings the eyes of the surgeon close to the relevant anatomy.

6. Retraction devices

The self-retaining retractor is one of the most important instruments introduced into modern neurosurgery. Ideally, a brain retraction system should not compress the brain at all, but protect it. The injurious effects of retraction are directly related to the force of protective retraction and how long it is applied. Currently, the primary functions of retraction systems are to protect the brain, to provide gentle retraction during the initial stages of dissection, and to counteract gravity during the course of a tumor resection where the overlying cortex is tending to fall into the cavity. The retraction system should include tapered and rectangular brain spatulas that are applied to the protected surface of the brain, flexible arms that can support the brain spatulas in any position within the operating field, and a series of clamps and bars for attachment of the system to the pinion head holder or the operating table.

7. Bipolar Forceps

Bipolar forceps are the most adaptive and functional tool available to the neurosurgeon. They not only provide bipolar coagulation, but are also the main instrument of dissection. Bipolar coagulation is routinely used to control bleeding from the scalp margins, on the dura, and at intracranial sites and has become fundamental to neurosurgery because

it allows accurate fine coagulation of small vessels, minimizing the dangerous spread of current to adjacent neural and vascular structures. Many kinds of bipolar forceps are now commercially available. It is important that a surgeon get accustomed to forceps of various shapes at the tip: sharp and dull, straight and curved. It is recommended that electrically insulated forceps (except for the tips) be used because they are likely to come into contact with brain retractors or brain tissue where electrical leakage could occur. If possible, the instruments should be held in a pencil grip between the thumb and the index finger, rather than in a pistol grip with the whole hand.

8. Monopolar coagulation

Monopolar coagulation is easy because it can be simply performed with the use of monopolar sticks and it is usually quite effective. For hemostasis over larger areas, special ball-tipped attachments to the monopolar cable are very efficient. They are available in a variety of sizes with straight and curved shafts. Because of the heat produced when using this method, copious irrigation following each short phase of coagulation is recommended. Some monopolar electrodes incorporate a suction cannula to aspirate the smoke during coagulation, which maintains a clear surgical field. Monopolar coagulation must be avoided close to major neurovascular structures, in the intradural space or in proximity to nerve or vascular bony protuberances within the sphenoid sinus.

9. Suction

A suction is another important tool. The best instrument for tumor enucleation is the suction apparatus. An inexperienced neurosurgeon tends to concentrate his attention on his dominant hand holding the forceps or dissector, but he should not forget that the suction is in his other hand. Suction tubes with blunt rounded tips are preferred.

10. Dissector

Many macrodissectors and microdissectors are widely used for microdissection around the cranial nerves, brainstem, and intracranial vessels.

11. Micro Doppler Probe

Prior to opening the dura mater and whenever the surgeon thinks it is appropriate (especially while working very close to vascular structures), it is of utmost importance to use the micro Doppler probe to insonate the major arteries.

12. Ultrasonic Aspirators

Ultrasonic aspirators have the ability to rapidly debulk large tumors but they must be used with extreme care, because they can quickly open through the surface of a tumor capsule and damage vessels and nerves adhering to the surface of the tumor.

Symposium I : Basics in the neurosurgical field

Part II

좌장: 조경기 (분당차병원), 김태영 (원광대병원)

Management of dural defect and CSF leak

양승호 (성빈센트병원)

Various bleeding control during surgery

홍창기 (강남세브란스병원)

Management of brain edema during surgery

송영진 (동아대병원)

Management of dura defect and CSF leak

Seung Ho Yang

Department of Neurosurgery, St. Vincent's Hospital, The Catholic University of Korea

뇌수술에 있어서 경막을 잘 봉합하는 것은 아무리 강조해도 지나치지 않다. 수술 후 뇌척수액이 새면 창상 감염 위험성이 커지고 입원 기간도 길어지면 재수술을 해야 하는 경우도 발생한다.

수술 후 뇌척수액 유출은 수술의 종류, 위치 및 환자 상태에 따라 그 위험성이 다르다.

방수가 보장되는 경막 봉합이 가장 기본이 된다. 최근에 여러 가지 인공 보강재를 시판되고 있어 수술자들의 선택이 폭이 넓어졌지만 명확한 지침이 없는 실정이라서 초심자들에게 고민이 되기도 한다.

본 발표에서 suture technique, duroplasty material, surgical sealant에 대해 기존 논문들 내용과 발표자의 경험을 공유하고자 한다.

경막 봉합의 원칙은 방수가 보장되는 경막 봉합을 시행하는 것이지만 그렇지 못하는 상황에서 여러 보강재들을 이용하여 여러 층으로 경막을 막는 것이 필요하다.

Various Bleeding Control during Surgery

Chang-Ki Hong

Department of Neurosurgery, Gangnam Severance Hospital, Yonsei University

Intraoperative intracranial bleeding during surgery can present abruptly or as a steadily advancing crescendo in a variety of neurosurgical settings. If not promptly brought under control, death or severe morbidity is not an uncommon outcome. The normal intuitive response to any rapidly bleeding site is to quickly apply pressure to the site and, if the bleeding continues or is vigorous, to pack whatever material is at hand against and into the site. In modern neurosurgical settings, various hemostatic materials are used in almost every open procedure, but these are rarely intentionally left within the patient.

As soon as intraoperative bleeding is recognized to be severe, one or more hemostasis-promoting materials such as Gelfoam, Surgicel, or Floseal are applied to the general region of hemorrhage, and some combination of cottonoids, cotton balls, or Raytec sponges is very quickly applied over these materials and is held in place with firm, manual pressure for several minutes. After a few minutes of applied pressure, clotting usually occurs both within the disrupted vessels and in the adjacent extravascular space, including within the applied packing materials. If no bleeding is apparent after watching the site for approximately 3 minutes to 5 minutes, the packing material is slowly removed under constant irrigation. If vigorous bleeding soon recurs, the packing technique may be repeated a few times. If severe hemorrhage recurs during or soon after each attempted removal, particularly if associated with a significant fall in systemic blood pressure, the packing materials are left in place and observed for a few minutes without applied pressure. Exposed brain tissue is then covered with moist Duragen, and the dura is left open. The galea is closed over a Jackson–Pratt drain, and the scalp edges are approximated with staples. Antibiotic dressing is applied with no bandaging. In all cases, including those in which the packing is left in, postoperative intravenous antibiotics are administered for the first 24 hours to 48 hours after surgery.

Management of brain edema during surgery

Young-Jin Song

Department of Neurosurgery, College of Medicine, Dong-A University Hospital

뇌종양 수술 중 발생하는 뇌부종을 예방하기 위해서 수십 년 전부터 여러 처치가 시행되어 왔다. 하지만, 뇌경막을 여는 동안 발생하는 심한 뇌부종의 경우 수술 접근을 어렵게 하고, 뇌 손상 등의 위험성이 증가하게 된다. 특히 두개골과 뇌경막을 제거후, 뇌부종이 심한 경우를 poor brain relaxation으로 표현할 수 있으며, 이러한 brain relaxation 정도가 뇌종양 수술 결과에 많은 영향을 미치게 된다. 뇌종양 수술에서 poor brain relaxation의 발생 빈도는 대략 5~6%정도 보고되고 있다. 원인으로 일차성 원인과 이차성 원인으로 나눌 수 있으며, 이차성 원인에는 수술과 직접적으로 관련된 손상과 마취와 연관된 요소로 세분 될 수 있다. 일차성 원인으로 고려되는 술전 환자의 전신 상태, 종양의 특징(고형성/낭성, 크기, 위치, 조직학적 특성 등), 및 술전 영상 검사에서 뇌부종으로 인한 midline shifting 정도 등을 통해 술전 brain relaxation 정도를 어느 정도 예측 할 수 있으며, poor brain relaxation을 술전 약물 치료(고삼투압액제 사용) 및 적절한 수술 계획(접근법 선택 및 뇌척수액 배액 여부 등)을 통해 최대한 호전시키는 것이 술중 어떠한 처치보다도 중요하다. 수술 자세를 준비하는 과정에서 정맥 유출을 용이하게 하기 위해 경부의 과도한 굴곡과 회전을 피해야 하며, 술중 혈중 산소 및 이산화 탄소 농도, 혈색소 수치, 혈압 정도, 사용되어지는 마취제의 종류와 마취 깊이 등 마취와 연관된 문제로 인해 brain relaxation에도 영향을 미칠 수 있으므로 뇌부종 발생시에는 반드시 마취의와 즉각적인 소통을 통해 이를 해결할 수 있도록 노력해야 한다. 술 중에 발생하는 이차적인 원인으로 뇌혈관 손상과 뇌건인에 의한 뇌손상 및 그외 두개강내 뇌혈종 발생 등이 있다. 이러한 경우 catastrophic brain swelling이 발생할 수 있다. 뇌건인으로 발생될 수 있는 뇌부종의 경우, local perfusion의 감소, 직접적인 뇌조직 손상 및 뇌혈관 압박 등이 원인으로 알려져 있다. 특히, 뇌기저부 종양의 경우에 부적절한 뇌건인으로 인한 합병증이 10% 정도까지 보고되고 있다. 이를 예방하기 위해선 견인에 있어서 가장 중요한 부분인 정확한 수술 접근법 선택, 수술 접근법에 따른 적절한 개두 크기 결정 및 뇌척수액 배액 등이 중요하며, 장시간 견인이 필요한 경우에는 간헐적인 견인으로 뇌조직과 뇌혈관을 최대한 보호하는 것이 무엇보다 중요하다. 뇌혈관의 손상에는 동맥 손상과 정맥 손상이 있으며, 동맥손상을 최대한 막기 위해선 측내 종양의 경우 subpial dissection을, 측외 종양의 경우 arachnoid layer를 유지하면서 sharp dissection이 필요하다. 제거하려는 종양 주위에 위치한 동맥의 근위부를 수술 초기에 미리 확보하는 게 안전하며, 접근 시에도 항상 정상부위에서 병변으로 조직을 박리해 나가는 것을 명심해야 한다. 정맥의 경우, 최대한 손상을 줄이고 유지하는 게 중요하다. 결론

적으로 뇌부종을 예방하고 brain relaxation을 호전시키기 위해 술전 철저한 수술 계획하에 수술을 시행하는 것이 뇌부종이 악화된 후 치료계획을 선택하는 것보다 더 효과적이다. 술 중 뇌부종이 악화될 시 항시 수술 자세, 마취와의 연관성, 뇌건인 및 혈관 손상으로 인한 뇌혈종 발생 등 모든 가능성을 염두 해 두어야 한다. 여러 방법을 통해 치료를 하였는데도 원인조차 찾지 못하는 경우에는 lifesaving 목적으로 손상된 뇌조직의 제거와 두개골 감압술까지 고려하는 게 현명할 수도 있다. 술 중 catastrophic brain swelling을 피하기 위해선 각 병변에 대한 수술 기법의 원칙을 명심하고 수술에 임하는 것이 무엇보다도 중요하다.

Symposium II: New era in diagnosis and treatment of malignant gliomas according to the new WHO classification

좌장: 고영초 (건국대병원), 홍용길 (서울성모병원)

What's update on the new WHO classification of CNS malignant gliomas

이경화 (화순전남대병원 병리과)

Treatment strategy for malignant gliomas according to the new WHO classification

김재용 (분당서울대병원)

Immunotherapy as a cutting edge treatment in malignant gliomas

김세현 (분당서울대병원 혈액종양내과)

Current and future of targeted therapy for malignant gliomas

강신혁 (고려대안암병원)

Surgical tactics of insular and eloquent area low grade gliomas

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What's update on the new WHO classification of CNS malignant gliomas

Kyung-Hwa Lee

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The 2016 World Health Organization Classification of Tumors of the Central Nervous System encompassed both a conceptual and practical progress since the previous classification of central nervous system (CNS) tumors, which was last revised in 2007. The WHO classification of CNS tumors uses molecular parameters in addition to histology to define many tumor entities and genotypic identification of tumor pathology has become a requisite feature of CNS tumor classification. Diffusely infiltrating gliomas have been reorganized based on mutations in isocitrate dehydrogenase (IDH). The diffuse glioma category now includes the WHO grade II and III astrocytomas and oligodendrogliomas, the grade IV glioblastomas, and the related diffuse gliomas (e.g. those of childhood). This approach separates astrocytomas that have a more circumscribed growth pattern, lack IDH gene alterations, and sometimes have BRAF mutations. In addition, the new classification incorporates H3 K27M-mutant diffuse midline glioma, RELA fusion-positive ependymoma, WNT-activated and SHH-activated medulloblastomas, and C19MC-altered embryonal tumour with multilayered rosettes. Other notable changes include the addition of brain invasion as a criterion for atypical meningioma and the introduction of a soft tissue-type grading system for the now combined entity of solitary fibrous tumor / hemangiopericytoma—a departure from the manner by which other CNS tumors are graded. The 2016 edition has deleted some entities, variants and patterns that no longer have diagnostic and/or biological relevance. The inclusion of molecular features into the diagnosis of CNS tumors begins a new era of tumor classification by the WHO. Although there is still much to be understood about genetic and epigenetic regulation of neoplastic cells, its consideration in disease management and prognostic evaluation now has established relevance into clinical care.

Treatment strategy for malignant gliomas according to the new WHO classification

Chae-Yong Kim

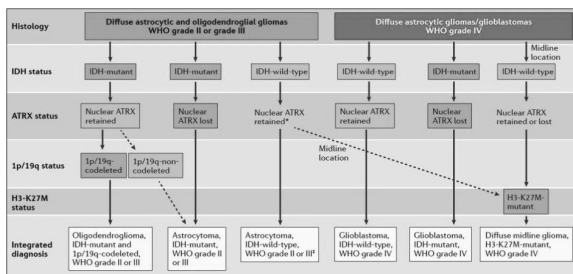
Department of Neurosurgery, Seoul National University Bundang Hospital, Seoul National University College of Medicine

뇌종양에 대한 새로운 WHO classification이 지난 2016년도에 발표 되었다. 이번 업데이트는 조직학적인 육안 소견에 따른 진단에 치우쳤던 지난 기준에서 분자생물학적 지표의 변이에 따른 진단을 도입하는 총화적 진단으로, 그 패러다임의 변화가 있었다. 그 중에서 뇌교종에 대한 변화를 살펴보고, 변화된 진단에 따른 치료 전략을 살펴보고자 한다.

아래는 신경교종에서 새로운 분류법의 중요한 변화를 정리한 것이다.

- 1) Formulating concept of how CNS tumor diagnoses are structured in the molecular era
- 2) Major restructuring of diffuse gliomas, with incorporation of genetically defined entities
- 3) Addition of newly recognized entities
 - A. IDH-wildtype and IDH-mutant glioblastoma
 - B. Diffuse midline glioma, H3 K27M-mutant
- 4) Deletion of former entities
 - A. Gliomatosis cerebri
 - B. Protoplasmic and fibrillary astrocytoma variants

이제 뇌교종을 진단할 때, 조직학적인 소견과 등급 이외에 IDH-mutation 상태를 필수적으로 평가해야 한다. IDH-mutant 그룹은 1p/19q co-deletion 검사를 하여 진단을 세분화하여야 하고, IDH-wildtype 그룹 중 시상, 뇌간, 또는 척수 같이 중양에 위치한 종양은 histone-H3-K27M mutation 검사를 추가로 시행해야 한다. 이러한 새로운 진단의 접근법은 다음 그림에 잘 요약되어 있다.



위와 같이 새로운 진단기준에 따르면, 기존의 astrocytoma, anaplastic astrocytoma은 IDH mutation 여부에 따라 다음과 같이 나누어지게 된다.

- Diffuse astrocytoma, IDH-mutant/ Diffuse astrocytoma, IDH-wild-type/ Diffuse astrocytoma, NOS
- Anaplastic astrocytoma, IDH-mutant/ Anaplastic astrocytoma, IDH-wild-type/ Anaplastic astrocytoma, NOS

이러한 분자지표들은 치료방향 결정이나 예후와 많은 상관관계가 있다고 잘 알려져 있다. 이제는 조직학적 소견과 등급이 같은 glioma라도 분자지표들의 변이 여부에 따라 서로 다른 치료 전략을 세워야 한다. 이에 새로운 WHO classification에 따른 malignant glioma의 치료 전략에 대해 살펴보려고 한다.

Diffuse midline glioma, H3 K27M-mutant

이는 이전과 크게 달라진 개념으로 조직학적인 등급에 무관하게 종양의 위치와 분자생물학적 표지에 따라 기존의 WHO grade 4 에 해당이 되며, 고로 이들은 지금의 glioblastoma 에 대한 표준치료(Stupp regimen)가 적용이 가능할 것이다. 이 부분에 대한 급여문제 등은 풀어나가야 할 과제이다.

IDH-1 wildtype Astrocytoma

이들은 mutant type 에 비하여 그 예후가 좋지 않으며, 특히 AA with IDH-1 wildtype은 Glioblastoma 와 거의 유사한 생물학적, 임상적 발현양상을 보이는 것으로 알려져 있어, 적극적인 치료가 필요할 것이다. Glioblastoma 와 동일한 치료를 시행하여야 할 것으로 판단된다. 기존의 분류법 상에서 grade 3 신경교종에 대하여는 다수의 3상 임상시험이 진행 중인데, 이들 결과에 따라 치료 프로토콜이 정해질 수도 있겠지만, IDH-1 wildtype Astrocytoma 혹은 IDH-1 wildtype Anaplastic Astrocytoma는 등급에 무관하게 ‘aggressive’ 한 접근이 필요할 것으로 본다. 반면 IDH-1 mutant type의 astrocytoma는 기존에 grade 2 astrocytoma와 유사한 정도에서 치료 접근을 유지하되, 새로운 protocol을 만들기 위한 노력은 계속되어야 할 것이다.

Glioblastoma: IDH-1 mutant vs IDH-1 wildtype

현재는 IDH-1 의 상태에 무관하게 같은 표준치료 프로토콜이 적용되고 있으나, 향후 IDH-1 의 상태에 따라 mutant 군과 wildtype군은 그 세부 분류 (TERT 나 ATRX의 상태, MGMT promoter methylation 여부 등등)에 따라 치료 프로토콜을 달리 적용해야 할 것으로 전망된다. 새로운 프로토콜을 적용하기 위한 임상시험도 이제는 패러다임이 바뀌어 이들 분자생물학적 분류를 기반으로 하는 디자인으로 바뀌어야 하고, 이들 결과에 따라 그동안 10여년 이상 사용되어 오던 Stupp regimen도 변화할 가능성이 높아 보인다.

이들 대표적인 변화를 보인 종양 이외에도 각 세부 분류에 따른 각 종류의 신경교종들은 그들의 각각의 특성에 맞는 치료 전략이 필요하며, 이와 더불어 보험관련 현안을 시급히 해결되도록 학회 차원의 노력이 필요할 것이다. 이에 신경교종을 치료하는 모든 의료진의 노력과 합의가 점점 더 중요해 지고 있어 활발한 논의를 통하여 풀어나가야 할 것이다.

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Immunotherapy as a cutting edge treatment in malignant gliomas

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면역기능을 활성화시켜서 암을 치료하려는 노력은 과거부터 많은 시도가 있었다. 그러나, 그 동안 암치료에는 Interleukin-2, Interferon alpha 가 일부 신장암, 흑색종 정도에서만 이용되었고 다수에서는 효과를 얻지 못하는 경우가 많았다. 2010년도 이후 T-임파구와 같은 면역세포를 억제하는 면역관문(immune checkpoint)인 CTLA-4와 PD-1/PD-L1에 작용하는 Ipilimumab, Nivolumab, Pembrolizumab과 같은 면역관문 억제제(immune checkpoint inhibitor)들이 다양한 암종에서 뛰어난 효과를 보여주고 있다. 특히, 흑색종, 비소세포폐암, 방광암, 신장암에서는 이미 미국 FDA의 허가를 받았고 임상에서 이용되고 있다. 가장 최근 연구들에서는 비소세포폐암의 1차 치료제로 그 동안 이용하던 백금기반의 세포독성 항암제보다도 우월한 효능과 뛰어난 내약성을 보여주었다.

교모세포종(Glioblastoma, GBM)은 말초혈액의 면역기능을 저하시킨다는 것이 알려져 있었다. 따라서, 면역 저하를 유발하는 혈액의 물질들에 대한 연구들이 지속적으로 이루어졌으며, TGF- β , Interleukin-10, Prostaglandin E2 등이 후보 물질로 거론되어 왔다. 면역을 저하시키는 물질을 차단하기 위해서는 가장 직접적으로 그 물질을 분비하는 종양 자체를 제거하는 방법이 확실할 것이지만, 그 외에도 TGF- β 에 작용하는 약제를 투약하거나 암세포에 대한 면역기능을 활성화 하기 위한 암 특이 백신을 개발하는 노력들이 있었다. 최근에는 앞서 언급한 면역관문 억제제들을 이용하여 GBM을 치료하고자 하는 임상연구들이 진행 중에 있다.

KEYNOTE-028은 여러 암종에 대한 1상 연구로 그 중 GBM 환자를 대상으로 시행한 결과가 2016년 SNO에서 발표되었다. Reardon 등은 26명의 bevacizumab을 투약 받지 않은 GBM 환자들에게 Pembrolizumab 10 mg/kg를 매 2주마다 투약하였는데, 그 중에서 1명의 환자가 RECIST v1.1에 따라서 부분반응(Partial Response)였고 12명의 환자가 안정반응(Stable disease)였다. 4명의 환자는 각각 54, 70, 84, 86 주의 기간 동안 투약을 하였다. 3도 이상 또는 면역관련 이상반응은 장염(2명, 8%), 갑상선 기능 저하 (2명, 8%), 관절통 (1명, 4%), 당뇨 (1명, 4%) 등이 보고되었고 기존의 연구들과 다르지 않았다. KEYNOTE-028 외에도 Nivolumab의 효능을 기존 치료와 비교하는 3상 연구가 진행 중에 있으며, Pembrolizumab과 Bevacizumab을 병합 투약하는 연구 등이 진행되어 결과보고를 기다리고 있다.

진행되었거나 진행중인 다양한 면역치료 임상시험의 결과를 토대로 실제 환자들에게 면역치료를 시행하게 될 것으로 예상이 된다. 면역치료가 과연 어떤 환자군에서 효과적인지, 어떤

약제와 병합하였을 때 더욱 높은 효과를 보여주는지 앞으로 이 분야에서 많은 연구들이 이루어져야 할 것이다.

Current and future of targeted therapy for malignant gliomas

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Malignant gliomas are highly devastating primary brain tumors. It has been known that standard treatment regimen is maximal safe surgical resection, radiation therapy and chemotherapy. However, median survival still remains poor. Previously, it was found that temozolomide chemotherapy can increase patient survival with modest toxicity and MGMT methylation status is known as a critical prognostic factors. Nonetheless, malignant gliomas are not curable diseases and various factors should be considered to develop treatment strategy including molecular subtypes, intratumoral heterogeneity, cancer stem cell, altered metabolism, microenvironments and so on.

Considering the issues for malignant glioma management, several strategies are developed at now and some of them are going to be clinical trial including EGFR vaccine, Novocure, ABT-414 and checkpoint inhibitor. In addition, precision medicine is now upcoming to identify new target drugs. In the near future, new combination regimens could also be a potent strategy.

Surgical tactics of insular and eloquent area gliomas

Chul-Kee Park

Department of Neurosurgery, Seoul National University College of Medicine

There is no controversy about the prognostic power of extent of resection on survival in modern concept of glioma surgery. “Maximal safe resection” is a gold standard applicable to most of gliomas. To achieve maximal safe resection, various technologies are in practice such as neuronavigation system, fluorescence-guided surgery, and intraoperative electrophysiological monitoring. However, gliomas located at eloquent area, among which the good example is insular area, are still surgically challenging despite the current surgery-supporting systems. The core tactics to accomplish the successful resection for gliomas at eloquent area are the patient position and the transcortical window technique to access the tumor. The surgeon should preconceive 3-dimensional spatial structures of tumor and adjacent structures before surgery to access the key area of the tumor. The key area means the most difficult to reach, which is usually the deepest part of the tumor from the surface or the part shrouded in eloquent area. The position and approach should be aimed for the key area, not for the face of the tumor. In this presentation, surgical approach of insular gliomas at eloquent hemisphere, hippocampal gliomas, posterior thalamic gliomas, and gliomas involving motor-sensory cortex will be discussed with illustrative cases.

Breakfast Seminar

좌장: 김충현 (한양대구리병원)

Phase III randomized trial of autologous cytokine-induced killer cell
immunotherapy for newly diagnosed glioblastoma in Korea

공두식 (삼성서울병원)

Phase III Randomized Trial of Autologous Cytokine-Induced Killer Cell Immunotherapy for Newly Diagnosed Glioblastoma in Korea

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Do-Hyun Nam¹, Shin-Hyuk Kang², Jae Won Lee³, Jong-Hee Chang⁴, Jeong-Hoon Kim⁵,
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Purpose: Adoptive cell immunotherapy involves an ex vivo expansion of autologous cytokine-induced killer (CIK) cells before their reinfusion into the host. We evaluated the efficacy and safety of CIK cell immunotherapy with radiotherapy-temozolomide (TMZ) for the treatment of newly diagnosed glioblastomas.

Experimental design: In this multi-center, open-label, phase 3 study, we randomly assigned patients with newly diagnosed glioblastoma to receive CIK cell immunotherapy combined with standard TMZ chemoradiotherapy (CIK immunotherapy group) or standard TMZ chemoradiotherapy alone (control group). The efficacy endpoints were analyzed in the intention-to-treat set and in the per protocol set.

Results: Between December 2008 and October 2012, a total of 180 patients were randomly assigned to the CIK immunotherapy (n = 91) or control group (n = 89). In the intention-to-treat analysis set, median PFS was 8.1 months (95% confidence interval (CI), 5.8 to 8.5 months) in the CIK immunotherapy group, as compared to 5.4 months (95% CI, 3.3 to 7.9 months) in the control group (one-sided log-rank, p = 0.0401). Overall survival did not differ significantly between two groups. Grade 3 or higher adverse events, health-related quality of life and performance status between two groups did not show a significant difference.

Conclusions: The addition of CIK cells immunotherapy to standard chemoradiotherapy with TMZ improved PFS. However, the CIK immunotherapy group did not show evidence of a beneficial effect on overall survival.

Key words: immunotherapy, autologous cytokine-induced killer cell, glioblastoma

Review of 2016 ASNO meeting

좌장: 김오룡 (영남대병원)

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노태훈 (아주대병원)

Scientific Session

좌장: 김영규 (충북대병원), 정신 (화순전남대병원)

Two Cases of Delayed Hemorrhage with Unknown Cause after Brain Tumor Surgery

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Objective

Postoperative hemorrhage after intracranial surgery is one of the well-known complications. But delayed hemorrhage that begins at regions unrelated to surgical field is uncommon. We herein present patients with delayed hemorrhaged with unknown cause after brain tumor surgery.

Materials and Methods

Case 1; A 68-years-old male underwent surgery for Lt sphenoid ridge meningioma. Post-operative CT scan showed GTR of tumor with no hemorrhage. But after 24 hours, his consciousness was deteriorated, and CT scan showed hemorrhage where the tumor was removed. Emergency operation was performed, and bleeder was branch of MCA under normal cortex. Patient was recovered his consciousness with alertness. But 4 hours later, his consciousness was deteriorated again. CT scan showed re-bleeding on same site. So reoperation was performed, and bleeder was Lt M2 inf. branch which was different from previous operation. 1 day later, CT scan showed brain swelling because of infarction and rebleeding. So we performed 3rd re-operation. When the hematoma was removed, massive bleeding from MCA main trunk was started. Several aneurysmal clips were applied and we considered bypass surgery, but could not be performed because STA was injured by several operations. After 5 days of coma therapy, patient was transferred to the regional hospital.

Results

Case 2; A 46-years-old male underwent surgery for epidermal cyst. Subtotal resection was performed without neurological deterioration. 10 days later, patient readmitted our hospital because of seizure. CT scan showed hemorrhage on remnant tumor site. Emergency operation was performed. M1-M2 dissection or outpouching of vessel wall was observed, so we clipped aneurysm and sutured dissection portion. After operation, brain swelling & MCA territory infarction were worsened. So coma therapy was performed following 2nd operation for decompressive wide craniectomy.

Key Words

brain tumor, delayed hemorrhage, postoperative hemorrhage

Development of Extratumoral Cyst-like Lesion in Intracranial Schwannomas following Gamma Knife Radiosurgery

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Cyst formation after GKS for intracranial schwannomas rarely occurs. We report two patients that developed symptomatic extratumoral cyst-like lesions at more than 52 and 46 months after GKS, although these patients had acceptable tumor controls and no symptoms just before then. During the surgery, yellowish, clotty cyst-like lesions, which were distinct from the surrounding tumor, were observed. The microscopic examination of these lesions revealed thin lining layer without definite epithelium with pinkish amorphous materials, but without tumor cells. Long-term follow up of intracranial schwannomas is important, and if patients become symptomatic, it is required to consider development of extratumoral cyst-like lesions and perform thorough evaluation.

Key Words

Cyst, Schwannoma, Gamma Knife radiosurgery

Orbitozygomatic Approach to Meningioma involving Infratemporal Fossa and Orbit: A Case Report

Heejong Hwang, Sung-Jin Cho

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Objective

In general, surgical approach should be selected appropriately according to the location of the meningioma. If meningiomas occur at multiple sites, the choice of surgical approach should be more cautious.

Materials and Methods

A case 59 years old female, patient was found to have Homogeneous enhancing soft tissue mass involving left orbit, left pterygopalatine fossa, left cavernous sinus, left sphenoid sinus, left masticator space, left retromaxillary fat pad with bony involvement of left pterygoid plate and petrous apex in magnetic resonance imaging. Our impression is lymphoma. However, the patient is diagnosed with meningioma at the biopsy. So we planned combined surgery with Otorhinolaryngology. We chose the orbitozygomatic approach.

Results

We performed partial resection of tumor at left retromaxillary fat pad, left infratemporal fossa and orbit as planned.

Conclusion

As a result, it was a successful surgical approach. So we introduce this case about the importance of the surgical approach.

Key Words

orbitozygomatic, approach, meningioma, orbit, pterygopalatine

Unusual Clinical Course of Glioblastoma

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Objective

Glioblastoma (GBM) is the most common and the most malignant primary brain tumor in adults, accounting for ~12-15% of all intracranial neoplasms. Despite advances in surgical, medical and radiation therapies, the mortality of GBM remains high, with a median survival ranging between 40 and 70 weeks. Extracranial metastases of GBM are extremely rare, occurring in < 2% of patients.

Materials and Methods

We present a 67-year-old man with histologically confirmed GBM. The patient remained well for nearly 1 year, with no signs of recurrence. He then presented severe right sided orbital and facial pain. He showed severe injection and chemosis of right sided conjunctiva. Laboratory examination presented thrombocytopenia.

Results

Magnetic resonance imaging of brain showed multiple tumors in bilateral extraocular muscles (EOM) and right side infratemporal fossa. However, there was no recurrence in intracranial area. Multiple metastatic tumors in neck and whole vertebrae were detected in positron emission tomography of whole body. We performed biopsies in bone marrow and EOM. Pathological results turn out to be metastatic GBMs.

Conclusion

We report this rare case with review of literatures.

Key Words

glioblastoma, extracranial metastasis

Intermediate Pilomyxoid Astrocytoma in 5-year-old Boy

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Pilomyxoid astrocytoma, an entity described as a histological variant of pilocytic astrocytoma, is a rare primary tumor of the central nervous system. It is usually located in the hypothalamic–chiasmatic area, affecting children with a mean age of 10 months. It has a high rate of recurrence and cerebrospinal fluid dissemination, which may be present throughout the neuroaxis. Some cases, as in this present one, have simultaneous histological features of pilocytic and pilomyxoid astrocytomas, constituting a group called intermediate pilomyxoid astrocytoma. A 5-years-old male presented with headache and vomiting of 10 days duration. Magnetic resonance imaging showed a about 4.5 x 4cm large bulging solid tumor protruding into 4th ventricle which is originated in cerebellar vermis. We performed suboccipital craniectomy and gross complete surgical removal. Histopathological examination revealed an intermediate pilomyxoid astrocytoma. Tumor composed of astrocytic cells occasionally showing long bipolar cytoplasmic processes, moderate cellularity. No necrosis or microvascular proliferation was seen. Very few Rosenthal fibers and eosinophilic granular bodies were seen. The tumor cells showed GFAP and CD56 positivity, but were negative for p53, EMA. Ki-67 positivity ranged from 1 to 2%. The tumor was not recurred after one year.

Key Words

Intermediate pilomyxoid astrocytoma

Huge Sellar Xanthogranuloma Occurring after Gross Total Resection

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Objective

Xanthogranuloma has been reported to comprise a distinct entity from a Rathke's cleft cyst (RCC) or craniopharyngioma (CP). They remain unknown whether they are derived from RCCs or CPs following extensive inflammation and metaplasia, to the point that no epithelium is readily identifiable. These lesions tend to occur in younger patients (mean 27 years), have a smaller diameter, and remain primarily intrasellar with infrequent calcification.

Results

The 36 years-old men presented our hospital with visual deterioration. At the time of visit, there were no neurological problems other than visual field defect and diabetes insipidus. He visited our hospital in 2007 due to decreased vision and diabetes insipidus, and underwent transphenoid surgery for pituitary RCC. Since then, he has received treatment at our hospital for hormonal disorders. Through preoperative imaging study, the author suspected craniopharyngioma and underwent surgery. During the operation, the adhesion of the tumor to the surrounding major neurovascular structures was severe in the naked eyes, but the tumor could be removed more easily than expected. The postoperative histologic findings were confirmed as xanthogranuloma.

Conclusion

Compared to the previous literature, this case is a case where the size of xanthogranuloma is very large in a sellar region and it can be proved that it originated from the Rathke's cleft cyst.

A Retrospective Review of 36 Patients with Pituitary Apoplexy

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Objective

Pituitary apoplexy is a rare and unpredictable complication of frequently previously undiagnosed pituitary adenoma. We retrospectively analyzed the clinical course of pituitary apoplexy in a single institution.

Materials and Methods

Between 2001 and 2014, a total of 45 patients was diagnosed as pituitary apoplexy. After exclusion of nine patients who treated with surgical resection within 3 months of onset, a total of 36 patients were enrolled in this study. This study consisted of 23 male and 13 female patients. The median age was 39 years (range, 25–78). Four (11%) of 36 patients had no previous history of pituitary tumor. The median follow-up duration was 50 months (range, 2–168). Twenty-two (61%) of 36 patients had visual disturbance and twenty patients (55%) had hypopituitarism.

Results

During follow-up period, five (14%) of 36 patients underwent surgical resection. The median time from presentation to surgery was 20 months (range, 5–70). The reason for surgical resection included increased tumor size in 3 cases and neurological deterioration in 2 cases. Thirty-two (86%) of 36 patients were managed conservatively. At the last radiological follow-up, complete or near-complete resolution occurred in 21 patients (68%). At the last clinical follow-up, visual disturbance was recovered in 21 (95%) of 22 patients, and then, 12 (60%) of 20 patients who had hypopituitarism needed no hormone replacement therapy.

Conclusion

In this study, we report the spontaneous resolution of pituitary apoplexy and recovery of visual disturbance during the follow-up period. Conservative management should be considered in the absence of rapid clinical deterioration.

Key Words

pituitary apoplexy, regression of pituitary adenoma

A Case of Lateral Clivus Chordoma

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Introduction

Intracranial chordoma is a locally aggressive and rare tumor of the skull base that is thought to originate from embryonic remnants of the primitive notochord. Although this arises midline in site typically, it may arise off the midline. The approach into the space posterolateral to the paraclival internal carotid artery is still challenging although recent advancement of endoscopic technique using angled endoscopes made anterior approach effective for removing laterally existing clival chordoma.

Case presentation

A 64 years-old male patient admitted to our hospital with clivus chordoma for which he received transsphenoidal surgery 2 years ago from another hospital. The imaging study revealed the recurred tumor in the lateral part of the clivus. The tumor was located posterolateral to the paraclival internal carotid artery and medial to trigeminal nerve. He underwent tumor removal through the lateral skull base approach using the transpetrosal approach.

Discussion

The surgical resection is gold standard of chordoma treatment, making aggressive surgical resection the most successful therapeutic modality. The region posterolateral to the intrapetrous and paraclival internal carotid artery is hard to access through the anterior approaches and so may be vulnerable to tumor persistence. Transpetrosal approach can shorten the distance to the lateral clival region and improves the surgical access.

Conclusion

Lateral clivus chordoma can be accessed successfully using the transpetrosal approach.

Key Words

clivus chordoma lateral approach

Poster Session

Clinical and Radiological Characteristics of Angiomatous Meningiomas

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Objective

Angiomatous meningioma is a rare histological subtype of meningioma. Therefore, this specific medical condition is rarely reviewed in the literature. In the present work, we report the clinical and radiological features with postoperative outcomes of angiomatous meningioma.

Materials and Methods

This retrospective study included the patients who were pathologically diagnosed with angiomatous meningioma after surgical resection between February 2010 and September 2015 in our institute. We analyzed the clinical data, radiological manifestation, treatment and prognosis of all patients.

Results

The 15 patients (5 males and 10 females) were diagnosed with angiomatous meningioma during the study period. The median age of patients at the time of surgery was 63 years (range: 40 to 80 years). According to Simpson classification, 7, 5, and 3 patients achieved Simpson grade I, II, and IV resection, respectively. In the follow-up period, recurrence was noted in one patient. Ten out of the 15 patients showed homogeneous enhancement. Two patients demonstrated cystic changes. There was no occurrence of calcification or hemorrhage in our patients. Characteristically, 14 out of 15 patients showed signal voids of vessels. Significant peritumoral edema was observed in the majority of tumors (67%).

Conclusion

Angiomatous meningiomas are rare benign meningioma. Brain images of angiomatous meningioma usually demonstrate signal void signs and peritumoral edema. In the present study, angiomatous meningiomas showed good prognosis after surgical resection.

Key Words

Angiomatous meningioma, Brain edema, Magnetic resonance imaging, Recurrence

Pituitary Stalk Metastasis of a Myxopapillary Ependymoma: Case Report

Jae Joon Lim, Kyunggi Cho

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Objective

We present the case of a 13-year-old child with pituitary and prepontine cistern seeding of an myxopapillary ependymoma.

Materials and Methods

Myxopapillary ependymoma (MPE) is a slow-growing tumor occurring most often in spine. It originates from the filum terminale in the area of the conus medullaris and cauda equina, and is considered a benign lesion. Despite of this benign nature, recurrence of tumor is well known. In the pediatric ages, primary MPE seeding is well documented and treated through gross total resection, followed by irradiation.

Results

The patient underwent gross total resection of the spine lesions 1 year ago. After 1st surgery, cerebellopontine area (CPA) and pituitary stalk seeding was seen, the patient underwent gross total resection of CPA lesion at other hospital. Because of the newly developed patient's symptom, we made the decision to operate the pituitary stalk lesion.

Conclusion

The pituitary stalk and prepontine cistern metastasis lesion was removed through modified lateral supraorbital approach successfully.

Key Words

myxopapillary ependymoma; primary seeding; pituitary stalk; modified lateral supraorbital approach

Rapid Growth of Meningioma in the Elderly: Report of Two Cases

Myung Hoon Han, Choong Hyun Kim

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Objective

Diagnosis of incidental meningioma has become common with the increasing availability of brain diagnostic imaging modalities and an ageing population. Therefore, this makes it a challenge for neurosurgeons as to whether these lesions should be treated, especially in the elderly.

Materials and Methods

Previous studies agreed that the annual growth rate of meningioma is relatively higher in younger patients. However, we experienced two cases of rapid growth meningioma in elderly patients.

Results

The first female patient of 80 years old presented our hospital with memory disturbance, and was regularly followed due to incidental small falx meningioma. She had a brain MRI and we found huge meningioma compared to the MRI undergone 2 years ago. The second female patient of 85 years old visited our hospital with mild cognitive impairment. She had burr hole surgery due to chronic subdural hematoma in our hospital about 4 years ago. She had CT scans and there was a huge meningioma in the left frontal convexity. The patient also underwent MRI on the same day and we found massive active bleeding from meningioma at the time. She died 3 days after MRI was performed.

Conclusion

Therefore, we suggest that a careful clinical follow-up with imaging studies is necessary, even in elderly patients with small and asymptomatic meningioma.

Key Words

Meningioma, elderly

A Case of Coincidental Intrасellar Chordoma and Pituitary Adenoma

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Objective

Although chordomas are midline tumors, primarily intrasellar chordomas are extremely rare. Furthermore, up to now, an entirely intrasellar chordoma with a coincidental pituitary adenoma has not yet been reported.

Materials and Methods

In this report, the authors describe the case of a 68-year-old female with partial abducens nerve palsy in the right eye due to the intrasellar cystic tumor.

Results

After endonasal trans-sphenoidal surgery, intraoperative and histopathological findings confirmed the co-occurrence of an entirely intrasellar chordoma and pituitary adenoma.

Conclusion

To our knowledge, the present case is the first reported case of an entirely intrasellar chordoma with a nonfunctioning pituitary adenoma.

Key Words

Chordoma; Pituitary adenoma; Sella turcica; Cyst

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