Secondary Degeneration of the Pyramidal Trat following Cerebral Hemispherectomy in a Man

Department of Surgery, Division of Neurosurgery, Seoul National University, College of Medicine, Seoul, Korea.

Bo-Sung Sim, M. D.

INTRODUCTION

Dandy[8] in 1928 performed the first cerebal hemipherectomy in patients with infiltrating gliomas and Krynauw[20] in 1950 carried out a similar operative procedure in patients with infantile type hemiplegia associated with uncontrollable convulsions and mental aberrations. Subsequently many surgeons have performed the procedure (Table I and II.) and it is this material that has permitted further assessment of the various tracts and reflex arcs in the central nervous system. Among the observed phenomena has been the postoperative retention of some of the contralateral motor and sensory functions, especially in those patients who preoperatively had partial loss of these abilities.

Karnosh[17] (1937) made sections of the lower pons just above the pyramidal decussation in a patient who survived 29 days after right cerebral hemispherectomy for a brain tumor. He used myelin sheath staining methods. These sections revealed a demyelinized pyramidal tract at the decussation, but those fibers which were destined to remain uncrossed showed no such defect. Lassek and Evans[21] (1945) reported that of three cases of human cerebral hemispherectomy for the removal of brain tumors, one patient survived for 330 days after operation. Stained sections of the brain stem in this case showed fibers in the pyramidal tract other than those originating in the cerebral cortex. Powell[29](1952) described the residual neurons in the thalamus in a patient who survived for 24 days after the cerebral hemidecortication. Austin and Grant[2] (1955) described their observations in four patients of right-sided hemispherectomy in adults. In one patient who survived two and one-half months postoperatively, thalamic sections revealed a complete ipsilateral degeneration of the nucleus ventralis posteromedialis.

<Table I> CEREBRAL HEMISPHERECTOMY FOR BRAIN TUMORS REPORTED SINCE 1928

Authors	Published Year	No. of case	No. of postoperative death
Dandy[8]	1928	5	4
O-Brien[28]	1932	1	0
Dandy[9]	1933	3	3
Gardner[13]	1933	3	2
Zollinger[32]	1934	1	1
Karnosh[17]	1937	1	1
Rowe[31]	1937	1	0
Karnosh & Gardner[18]	1940	1	1
Karnosh & Gardner[19]	1941	4(-2)	(2)
Lassek & Evans[21]	1945	3	3
Bell & Karnosh[3]	1949	(1)	0
Marshall & Walker[23]	1950	3	0
Mensh, Schwartz & Materazzo[26]	1950	1	0
Crockett & Estriodge[7]	1951	4	4
Hillier[15]	1954	1	0
Johnson, French & Peyton[16]	1954	1	0
Austin & Grant[2]	1955	4	-
Gardner, Karnosh, McClure & Gardner[12]	1955	10(-3)	6(-2)
Sim	1960	1	1
Total		43 Cases	24 Cases

Except for these four reports no anatomical study of the cenetral nervous system after cerebral hemispherectomy has been reported in human cases. The purpose of this study is to present clinical and anstomical observations on the effect of cerebral hemispherectomy in a man.

CLINICAL STUDY

W.H.S., a 55 year-old man was admitted to the hospital on June 6, 1950. For three weeks he had noted the gradual development of weakness and incoordination in his left arm. Examination revealed a left arm paresis with hyperactive left biceps and triceps reflexes. There was bilateral papilledema. A

<Table Ⅱ> CEREBRA HEMISPHERECTOMY FOR INFANTILE HEMIPLEGIA REPORTED SINCE 1950.

Authors	Published Year	No. of Case	No. of Postoperative Death
Krynauw[19]	1950	12	1
Marshall & Walker[23]	1950	1	0
Obrador & Larramendi[27]	1950	1	0
Cairns & Davidson[6]	1951	3	1
Alcalde[1]	1951	4	0
Gross & Vlahovitch[14]	1951	2	0
MacKay[22]	1652	4	0
Feld & Lecasble[10]	1953	4	0
Mason & Shapiro[24]	1953	1	0
McKissock[25]	1953	18	1
Fleishhacker[11]	1954	5	0
Johnson, French & Peyton[16]	1954	7	0
Gardmer, Karnosh McClure & Gardner[12]	1955	1	0
Cabieses, Jeri & Landa	1957	5	2
TOTAL		68 Cases	5 Cases

diagnosis of right frontal lobe neoplasm was made. On June 13, 1950 a glioblastoma multiforme was subtotally removed from the right frontal region. The patient withstood the operative procedure well. On June 16,1950 he began to cough and a diagnosis of pneumonia was made. Evidence of infection persisted and on June 27, 1950 a chest roentgenogram revealed evidece of lung abscess. On July 5, 1950 under local anesthesia a segmental resection of the lung with removal of the abscess mass was carried out. His rocovery was uneventful and he was discharged from the hospital. While at home the patient did very well for the first week or tendays. He then began to develop severe right frontotemporal headache, and approximately 48 hours before the second hospitalization he began to vomit. He also noticed that the left arm and leg did not function as well as they did formerly. The patient's wife noticed some mental confusion. He was readmitted to the hospital on August 29, 1950. Examination at this time revealed an emaciated, acutely ill white male. There was nuchal rigidity. There was a small draining sinus on the right lateral chest wall. Breath sounds were present throughout the chest but on percussion there was dullness over the right anterior chest. Neurological examination revealed some memory impairment and slight disorientation. There was evidence of gliosis around the optic discs. There was a questionable right seventh nerve palsy of central type. The left arm and leg were spastic and the deep tendon reflexes were hyperactive on the left. The Babinski, Chaddock, and Gordon signs were positive bilaterally although superficial pain sense was questionably decreased on the left side.

Skull roentgenograms showed in addition to the bone flap a demineralized dorsum sella, and the calcified pineal gland appeared to be shifted to the left. Chest roentgenogram revealed rib defects in the right axillary line as well as pleural thickening in the same area. The chest otherwise appeared normal. The hemograms and urinalysis were normal. Serology was negative. Total plasma proteins were 8.4 gm% and the erythrocyte sedimention rate was 20 mm. in one hour. A sleep electroencephalogram was done. There were irregular high voltage slow waves of sleep mixed with some brief periods of 8-10/sec. activity in all areas. There was a definite hemispheric asymmetry with frequent random slow waves over the entire right hemisphere. During a brief period of waking. there was no normal activity over the right hemisphere, but the left hemisphere maintained the 8-10/sec. pattern. Further electroencephalographic localization suggested a large lesion involving the frontal, central and parietal areas on the right side.

Soon after admission the patient's nuchal rigidity increased. He began to develop respiratory difficulty, probably on a central neurogenic basis and at times he had difficulty in swallowing. It was the opinion of the neurology and neurosurgery staffs that the patient was probably terminal but it was felt that the patient might be benefited by a complete excision of the right cerebral hemisphere which contained the malignant glioma. On September 6, 1950, a total right cerebral hemispherectomy was performed, by Dr. French.

Tne operation note was recorded as follows: Under general anesthesia a skin incision was made from the frontal region back along the midline to the occipital region. A bone flap was turned down, so that the frontal, parietal, temporal and occipital lobes on the right were exposed. The dura was then opened with the base toward the saggital sinus. The previously made operative defect in the brain was visualized with scar and tumor tissue extending to the surface of the brain in this area.

The bone was rongeured away to better expose the temporal lobe. Cortical-electrodes were placed over the parietal, posterior frontal, and temporal areas. Recordings were taken before and after clipping of the middle cerebral artery. The internal carotid artery and its bifurcations were exposed before the corticalelectrodes were placed on the brain. After the electrocorticogram recordings were made the electrodes were removed and the brain was elevated and connections between the cortex and the falx along the medial surface of the cerebral hemisphere were clipped and coagulated. There was no evidence of extension of the tumor across the corpus callosum. The corpus callsum was then completely sectioned and the lateral ventricle entered. The branches arising from the anterior cerebral artery were clipped distal to the anterior communicating artery. The brain was dissected through the lateral aspect of the ventricle so that the caudate nucleus and thalamus would not be removed. The posterior cerebral artery was located and clipped. The occiptal and temporal areas were then dissected free and the right cerebral hemisphere was removed in one piece. A portion of dura overlying the tumor area was excised. The bone flap was replaced and the temporal muscle was sutured over the bone. The skin was closed in two layers.

Hemostasis was good except around the saggital sinus and the arachnoid granulations. It was necessary to place Gelfom over these areas and to suture the dura to the bone to control the bleeding. During the procedure the patient's systolic blood pressure fluctuated from 150 to 80mm. Hg. The patient received a total of 1500 cc. of blood. He also received intravenous procaine to control cardiac irregularities which occurred periodically during the procedure. The patient's general condition at the end of the operation wae good.

The pathological report of the excised cerebral hemisphere read: (a) Gross appearance— The specimen consisted of a right cerebral hemisphere which was present in its entirety lateral to the thalamus. (Fig. 1 and 2) The resected margin of this cerebral hemisphere was hemorrhagic and friable on cut section. In the temporo-fronto-pareital region there was a firm, yellow mass with areas of hemorrhage as well as small cystic areas. (Fig. 3) This mass measured 6 cm. in its greatest diameter. It extended diffusely into the surrounding cerebral parenchyma. This tumor wass extended to the surface of the temporo-parietal area in the region of the Sylvian fissure. (b) Microscopic examination- The specimen consisted of an aggregate of tumor cells which showed pleomorphism. The predominant cell type was that of the astrocytic series. Many gemistocytic cells were present. There was extensive hemorrhage and necrosis seen throughout the tumor ares as well as macrophages, mononuclear and pigmented fat granule cells. There was extensive endothelial proliferation in the blood vessel. Mitotic figures were seen in abundance. Pathological diagnosis was glioblastoma multiforme.

Postoperatively the patient did very well considering his debilitated condition. He was unable to take food or fluids orally and had to be sustained on intravenous and tube feedings. On the second day the patient began to open his eyes a little bit and seemed to realize that there was some activity around him. Neurological examination immediately postoperatively and fifteen days postoperatively revealed essentially the same findings. The patient said a few words such as "ouch" and "yes," He obeyed simple commands such as closing his eyes sticking out his tongue,or squeezing fingers with his right hand. He continued to have severe nuchal rigidity. There was a central type seventh nerve palsy on the left. Both superfical and deep pain sense appeared to be intact although possibly slightly decreased on the left. There was a flaccid paresis of the left leg and a spastic paresis of the left arm. The patellar and Achilles tendon reflexes were increased on the left. The biceps and triceps tendon reflexes were absent on the left. Babinski sign was suggestively positive on the left, and normal on the right. On September 25, 1950. the 19 th postoperative day, the patient's general condition seemed to be improving. He was more alert than he had been previously but that evening he suddenly developed respiratory difficulty. He was placed in oxygen and his general condition seemed to improve but at approximately 11 p.m. that evening he expired.

Autopsy findings were as follows: (a) Thorax- The left pleural cavity contained fibrous adhesions

and a considerable amount of greenish purulent material; the posterior aspects of the lobes were adherent to the thoracic cage. on the right side there was communication of the pleural cavity with the outside through a large defect in the thoracic cage in the region of the third and fifth rib in the right axillary line. (b) Lungs-The left lobes revealed considerable firmnes of the parenchym over the posterior and lateral aspects of the upper lobe and the entire lower lobe. Multiple sections through the upper lobe revealed marked edema of the upper portion of this lobe with areas of grey granular tissue in the lower portion of the lobe. The lower lobe contained an abscess cavity measuring 2.5 cm. in greatest diameter filled with thick greenish-yellow pus. This was situted in the lateral aspect of the lower lobe. The remaining portion of the lobe was firm and contained scattered granular grey firm areas mesuring up to 4 to 5 mm. in diameter. The bronchial tree contained abundant grey-green mucoid material. The pulmonary arteries appeared normal. Sections showed diffuse chronic inflammation. (c) Brain- External examination revealed that the right cerebral hemisphere had been surgically amputated with remnants of the thalamus remaining. There was hemorrhage and necrosis along the line of resection and a small area of necrosis measuring 1.5 cm. in greatest extent extended across the midline in the splenium of the corpus callosum. Microscopic examination revealed blood vessels congested with red blood cells in many areas, and numerous areas of microscopic hemorrhage with demyelinization and softening. The remainder of the brain showed no essential abnormality.

ANATOMICAL STUDY

The brain stem and the spimal cord, removed at autopsy were stained with Swank-Davenport staining method. The finding of these sections are as follows:

1. Upper Midbrain.This section was made through the superior colliculus and mammillary body. The section shows a swollen crus on the right side, and extensive degeneration in the middle portion of this crus, in both corticospinal and corticobulbar fasciculi, and scattered degenerated fibers in the posterior portion of this orus (occipitotemporopontine fasciculus) and in the anterior portion of the right crus (frontopontine fasciculus). But no evidence of degeneration is seen in the left crus. There are a few degenerated fibers in the superior collicular commissure.

2. Middle Midbrain. This section was made through the exit of the oculomotor nerve. The slide shows also a swollen crus on the right side and extensive degeneration in the middle portion of this crus, in both corticospinal and corticobulbar fasciculi, and scattered degenerated fibers in the posterior portion of the right crus (occipito-temporopontine fasciculus) and in the anterior portion of the right crus (frontopontine fasciculus). A few scattered degenerated fibers are seen in the anterior portion of the left crus, but these appear to be artifacts. The slide shows a few scattered degenerated fibers in the right medial lemniscus, but does not show any degenerated fibers in the left medial lemnicus. (Fig. 4)

3. Lower Midbrain. This section shows a swollen crus on the right side and extensive degeneration in the right crus except for the antero-medial portion. A few scattered degenerated fibers are seen in the right medial lemniscus. There are a very few scattered degenerated fibers in the anterior portion of the left crus, but these appear to be artifacts.

4. Upper Pons. This section shows swollen pyramidal bundles on the right side and extensive degeneration in the right pyramidal bundles, and scattered degenerated fibers in the medial lemniscus and also in the brachium conjunctivum of both sides. A very few scatterad degenerated fibers are seen in the left pyramidal bundles, but they appear to be artifacts. There are a very few degenerated fibers in the region of the region of the right fasciculus longitudinalis medialis and in the region of the region of the left tectospinal tract.

5. Middle Pons. This section was made through the exit of the trigenminal nerve. It shows swollen pyramidal bundles on the right side and almost complete degeneration in the right pyramidal bundles. There are scattered degenerated fibers in the right medial lemniscus and in the brahium conjunctivum of both sides. There are also a very few

degenerated fibers in the region of the right fasciculus longitudinalis medialis and in the region of the left tectospinal fasciculus. (Fig. 5)

6. Lower Pons. This section was made through the superior olivary nucleus and the exit of the acoustic nerve. The slide shows almost complete degeneration in the right pyramid, and scattered degenerated fibers in the right medial lemniscus. A few scattered degenerated fibers are seen in the left pyramid. But they appear to be artifacts. There are very few degenerated fibers in the region of the right fasciculus longitudinalis.

7. Middle Portion of the Inferior Olivary Nucleus. This section was made through the middle portion of the inferior olivary nucleus. It shows almost complete degeneration in the right pyramid. There are scattered degenerated fibers in the right medial lemniscus. A few scattered degenerated fibers are seen in the left pyramid and in the restiform body of both sides. The right restiform body shows much more extensive degeneration than in the left restiform. No evidence of degenerated fibers are seen in the internal arcuate fibers. (Fig. 6).

8. Obex. This section was made through the obex. It shows almost complete degeneration in the right pyramid. except in the regin of the anterior arcuate nucleus. There are scattered degenerated fibers in the right medial lemniscus and also in the fasciculus cuneatus of both sides. In both lateral aspects, just anterior to the nucleus of the spinal tract of the spinal tract of the trigeminal nerve, corresponding to the position of the dorsal spinocerebellar tract, there are a few closely grouped degenerated fibers. There are also a few scattered degenerated fibers in the left pyramid and in the fasciculus gracilis of both sides. No degenerated fibers are seen in the hypoglossal fibers or in the internal arcuate fibers on either sides. (Fig. 7).

9. Pyramidal Decussation. This section was made through the pyramidal decussation. It shows almost complete degeneration in the right pyramid, except in the region of the anterior arcuate nucleus, and also almost complete degeneration in the decussating fibers from the right pyramid to the opposite side. No degenerated fibers are seen crossing to the right lateral pyramidal tract. The section also shows scattered degenerated fibers in the fasciculus cuneatus of both sides, and a few scattered degenerated fibers in the fasciculus gracilis of both sides and in the left pyramid. The section also shows a few scattered degenerated fibers in both lateral margins, corresponding to the region of the dorsal spinocerebella tract, but these degenerated fibers are less evident than those in the section at the obex.(Fig. 8).

10. Section at the cl Level. This section shows almost complete degeneration in the left lateral pyramidal tract and in the right anterior pyramidal tract. There are scattered degenerated fibers in the right lateral pyramidal and in both posterior columns especially in the medial margin of the fasciculus cuneatus. There are scattered degenerated fibers in both lateral margins corresponding to the position of the dorsal spinocerebellar tract. A few degenerated fibers are seen in the central portion of the left sulcomarginal fasciculus, these degenerated fibers seem to be crossing from the central portion of the degenerated right anterior pyramidal tract to the opposite side through the anterior white commissure. There are also a few but definitely degenerated fibers which cross through the left anterior horn from these degenerated fibers in the left sulcomarginal fasciculus to the left lateral pyramidal tract, or vice versa. (Fig. 9)

11. Section at the C_2 Level. This section shows almost same changes as described in the section at the C_1 level. But the degenerated fibers in the left sulcomarginal fasciculus are more numerous than in the section at the C_1 level and this section does not show any degenerated fibers crossing the left anterior horn.

12. Section at the C_4 Level. This section shows almost complete degeneration in the left lateral pyramidal tract and in the right anterior pyramidal tract. There are scattered degenerated fibers in the right lateral pyramidal tract and in both posterior columns, especially in the medial margin of the fasciculus cuneatus. This section shows more numerous degenerated fibers in the left sulcomarginal fasciculus than in the section at the C_2 level. This section does not show any degenerated fibers in the lateral margin of the lateral column on both sides. (Fig. 10).

13. Section at the C_7 Level. This section shows

almost complete degeneration in the left lateral pyramidal tract and in the right anterior pyramidal tract. There are scattered degenersted fibers in the right lateral pyramidal tract and in both posterior columns, especially in the medial margin of the fasciculus cuneatus. There are a very few degen nerated fibers in the left sulcomarginal fasciculus, (Fig. 11).

14. Section at the T_4 Level. This section shows almost complete degeneration in the left lateral pyramidal tract and in the right anterior pyramidal tract. There are scatterd degenerated fibers in the right lateral pyramidal tract and in the posterior margins of both posterior columns, these degenerated fibers are more numerous in the fasciculus gracilis than in the fasciculus cuneatus on both sides. This section does not show any degenerated fibers in the left sulcomarginal fasciculus.

15. Section at the Middle Thoracic Level. This section shows almost complete degeneration in the left lateral pyramidal tract and in the right anterior pyramidal tract. There are scattered degenerated fibers in the right lateral pyramidal tract. This section does not show any degenerated fibers in either posterior columns. (Fig. 12).

16. Section at the T_{10} Level. This section shows almost the same changes as described in the section at the middle thoracic level.

17. Section at the L_5 Level. This section shows almost complete degeneration in the left lateral pyramidal tract and in the right anterior pyramidal tract and some degerated fibers in the right lateral pyramidal tract. (Fig. 13).

18. Section at the S_1 Level. This section shows diffusely scattered degenerated fibers in the left lateral pyramidal tract and scattered degenerated fibers in the right anterior and the right lateral pyramidal tracts. (Fig. 14).

19. Section at the S_2 Level. This section still shows scattered degenerated fibers in the left lateral pyramidal tract, and a few scattered degenerated fiers in the right lateral pyramidal tract and in the right anterior pyramidal tract.

SUMMARY AND CONCLUSIONS

The clinical and anatomical observasions on the effect of cerebral hemispherectomy in a man have been reported. The cerebral hemispherectomy was performed for recurrent glioblastoma multiforme and he survived nineteen days after operation. The brain stem and the spinal cord, removed at autopsy, were stained with Swank-Davenport staining method to determine the extent of degeneration of the pyramidal tract following cerebral hemispherectomy. In this case the right cerebral hemisphere was removed but care was taken to preserve the thalamus and caudate nucleus.

The postoperative findings in this case were as follows : On the second postoperative day the patient began to open his eyes and seemed to realize that there was some activity around him, he spoke a few words such as "ouch", and "yes," and obeyed simple commands such as "Open your eyes", "Stick out your tongue", "Squeeze my fingers", etc. There persisted a central type facial palsy on the left. Both Superficial and deep pain sense appeared to be intact although possibly slightly decreased on the left. There was a flaccid paresis of the left leg and a spastic peresis of the left arm. The patellar and Achilles tendon reflexes were increased on the left. The biceps and triceps tendon reflexes were absent on the left side. Babinski sign was suggestively positive on the left and normal on the right. The anatomical findings were as follows

1. The ipsilateral crus, pyramidal bundles, pyramid, decussating fibers and the contralateral lateral pyramidal tract showed almost complete degeneration.

2. There was no evidence of degeneration in the contralateral crus, pyramidal bundles, pyramid, nor decussating fibers.

3. There were scattered degenerated fibers in the ipsilateral lateral pyramidal tract, which fibers were traced down to the S_2 level, and almost complete degeneration in the ipsilateral anteral anerior pyramidal tract, which fibers were also traced down to the S_2 level.

4. In the position of the fasciculus longitudinalis medialis or antero-lateral columnar fibers (Boyce,[4] 1895) there were a very few scattered degenerated fibers on the ipsilateral side.

5. In the position of the tractus tectospinalis or

lateral columnar fibers of Boyce[4] (1895) there were a very few scatterd degenerated fibers on the contralateral side.

6. In the position of the dorsal spinocerebellar tract or accessory pyramidal tract of Probst[30] (1899) there were a few grouped degenerated fibers on both sides, which fibers were traced from the section at the obex to the section at the C_2 level.

7. There were a few scattered degenerated fibers in the contralateral sulcomarginal fasciculus in those sections at the C_1, C_2, C_4, C_6 and C_7 levels. These degenerated fibers appeared to be crossing from the degenerated ipsilateral anterior pyramidal tract to the contralateral sulcomarginal fasciculus through the anterior commissure.

8. There were a few degenerated fibers in the contralateral anterior horn from degenerated fibers in the contralateral sulcomarginal fasciculus to the contralateral lateral pyramidal tract, or vice versa. These degenerated fibers in the contralateral anterior horn were seen only in the section at the C_1 level.

9. There were scattered degenerated fibers in the ipsilateral medial lemniscus, which were seen up to the section at the upper portion of the midbrain, also in the brachium conjunctivum of both sides, in both restiform bodies and in the fasciculus cuneatus and gracilis of both sides. These degenerated fibers in the fasciculus couneatus and gracilis of both sides extended to the T_4 level, but more extensive degeneration was seen in the medial margin of the fasciculus cuneatus of both sides and this extended to the C_7 level.

The significance of these degenerated fibers is not clear and add tional investigation is indicated.

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——國 文 抄 錄——

大腦半球摘出後의 錐體路의 二次的變性

서울大學校 醫科大學 外科學敎室

沈 輔 星

1928年에 Dandy[8]는 처음으로 浸潤性 Glioma를 가진 患者로 反對側半身不隨는 治癒되지 않어도 좋으나 生命만이라도 維持할 수 있도록 하여달라는 患者에게 大腦半球摘出術을 施行하였으며, 1950年에는 Krynauw[20]가 小兒性半身不隨와 藥物療法으로도 到底히 調節되지 않는 痙攣과 易怒性 및 智能低下를 가지고 있는 患者에게 같은 手術을 施行하였다. 그後 많은 外科醫에 依하여 大腦半球摘出術이 施行되어 왔다.(第一 및 二表) 이들 많은 患者에게서 觀察된 所見中 興味있는 것은 한側大腦半球를 摘出하였는데도 不拘하고 反對側半身에 手術前과 같이 또는 그보다도 더 좋게 運動 및 知覺機能이 恢復되였다는 것이다. 이 事實은 現在까지의 神經解剖學的 또는 神經生理學的 知見으로는 到底히 說明할 수 없으며, 여러가지 推論은 發表되고 있으나 아직까지 確固한 解剖學的 說明은 내려지지 않고 있다.

1937年에 Karnosh[17]는 腦腫瘍을 治療할 目的으로 右側大腦半球를 摘出한 後 29日만에 死亡한 患者의 腦橋下部에서 切片을 作成하여 Myelin Sheath Staining method로 染色하여 觀察한즉 交叉하는 神經纖維는 變性을 일으키고 있었으나, 交叉하지 않는 神經纖維에는 變性이 없었다고 發表하였으며, Lassck와 Evans[21](1945)는 大腦半球摘出術을 施行한 患者 4名中 一名이 術後 330日 만에 死亡하였는데, 이 患者의 腦幹의 切片을 作成하여 檢査한 結果 大腦皮質에서 出發한 以外의 神經纖維가 錐體路內에 있는것 같다고 報告하였다. 그後 Powell[29](1952)과 Austin 및 Grant[2](1955)는 各各 大腦半球摘出後의 視丘(Thalamus) 內의 變性을 報告하였다.

上記 報告以外에는 아직 人體에서 大腦半球摘出後의 中樞神經系統內의 解剖組織學的變化를 報告한 것이 없다. 著者는 55歲되는 男子의 再發性 Glioblastoma Multiforme를 治療를 目的으로 施行한 右側大腦半球摘出術後 19日만에 死亡한 患者의 腦幹 및 脊髓內의 二次的變性을 觀察할 機會를 얻었기에 여기에 그 結果를 發表하고저 한다.

患者는 手術後 二日만에 눈을 열기 始作하는 同時에 周圍의 雰圍氣를 아는듯 하였으며 簡單한 말을 할수 있었고, 簡單한 命令에도 服從할 수 있었다. 顔面에는 手術前과 같이 中樞性顔面神經麻痺가 左側에 남아 있었으

며, 左側下肢에는 弛緩性運動麻痺, 左側上肢에는 强直性運動麻痺가 出現하였으며, 表在性 및 深部性知覺은 左側이 若干 低下되고 있는듯 하였다. 膝關節腱反射와 足關節腱反射는 左側에서 亢進되여 있었고, 二頭筋腱反射와 三頭筋腱反射는 左側에서 消失되고 있었으며, Babinski 徵候는 左側에서 陽性이 었다.

Swank-Davenport Staining method로 染色한 此患者의 腦幹 및 脊髓의 切片을 觀察한 結果는 다음과 같다. 即,

(1) 同側의 腦脚(Crus), 錐體束(Pyramidal bundles), 錐體(Pyramid), 交叉纖維(Decussating fibers) 및 反對的 側方錐體路(Lateral pyramidal tract)는 거진 完全한 變性을 보여 주었다.

(2) 反對側의 腦脚(Crus), 錐體束(Pyramidal bundles) 錐體(Pyramid) 및 交叉纖維(Decussating fibers)에는 아무 變性이 없는듯 하였다.

(3) 同側의 側方錐體路(Laeteral Pyramidal tract)에는 散在性으로 變性된 神經纖維가 있었으며, 이들은 第二薦髓部位까지 내려가고 있었다. 同側의 前方錐體路(Anterier pyramidal tract)는 거진 完全한 變性을 보여 주었으며, 이것도 第二薦髓部位까지 내려가고 있었다.

(4) 同側의 Fasciculus longitudinalis medialis 또는 Boyce[4] (1895)가 報告한 Antero-lateral Columnar fibers에 該當하는 部位에 數個의 變性된 神經纖維를 볼 수 있었다.

(5) 反對側의 Tractus tectospinalis 또는 Lateral Columnar fibers (Boyce,[4] 1895)에 該當되는 部位에도 數個의 變性된 神經纖維에 볼 수 있었다.

(6) 兩側의 後方脊髓小腦神經索(Dorsal Spinocerebellar tract) 또는 Probst[30](1899)가 報告한 副錐體路(Accessory Pyramidal tract)에 該當되는 部位에도 一群의 變性된 神經纖維가 있었으며, 이들은 Obex에서의 切片에서 부터 第二頸髓에서의 切片에 이르기까지 觀察할 수 있었다.

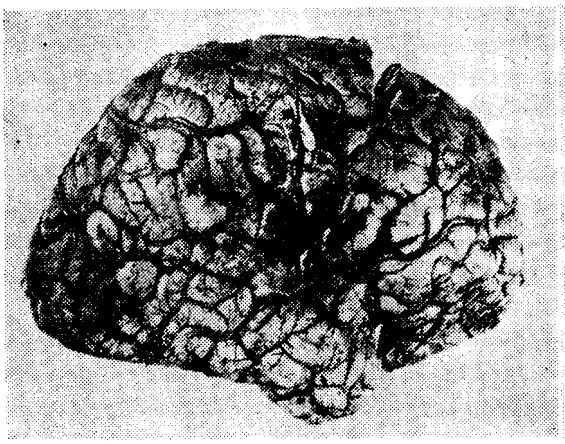
(7) 第 1, 2, 4, 6 및 7頸髓에서의 切片에서는 反對側 Sulcomarginal fasciculus內에 變性된 神經纖維들을 觀察할 수 있었는데, 이들 變性된 神經纖維들은 anterior white commissure를 經由하여 變性된 同側의 前方錐體路(Anterior pyramidal tract)에서 反對側의 Sulcomarginal fasciculus에 가고 있는 듯이 보였다.

(8) 反對側의 前角(Anterior horn)에는 反對側 Sulcomarginal fasciculus에서 反對側의 側方錐體路(Lateral pyramidal tract)로 또는 反對方向으로 가는듯한 變性된 神經纖維群이 있었으며, 이는 다만 第一頸髓에서의 切片에서만 觀察할 수 있었다.

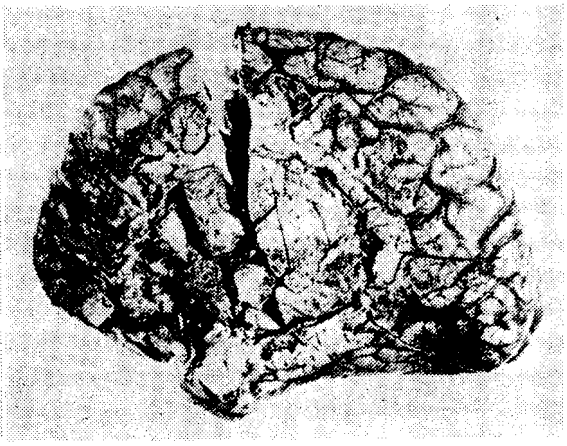
(9) 同側의 Medial lemniscus에는 散在性으로 變性된 神經纖維가 있었으며, 이들은 中腦上部에서의 切片에 이르기까지 觀察되였다. 兩側의 Brachium conjunctivum과 Restiform Body 그리고 兩側의 Fasciculus cuneatus 및 gracilis에도 散在性으로 變性된 神經纖維가 보였으며, 兩側 Frasciculus cuneatus 및 gracilis內의 變性된 纖維는 第四胸髓에서의 切片에 이르기까지 觀察되였으며, 兩側 Fasciculus cuneatus의 內條에는 더 明白한 變性된 神經纖維群이 있으며, 이들은 第七頸髓에서의 切片에 이르기까지 觀察되였다.

이들 腦幹 및 脊髓內에서 觀察된 變性된 神經纖維들의 解剖學的意義는 單 한例만 가지고는 判斷할 수 없으며, 將次의 많은 研究가 要望된다.

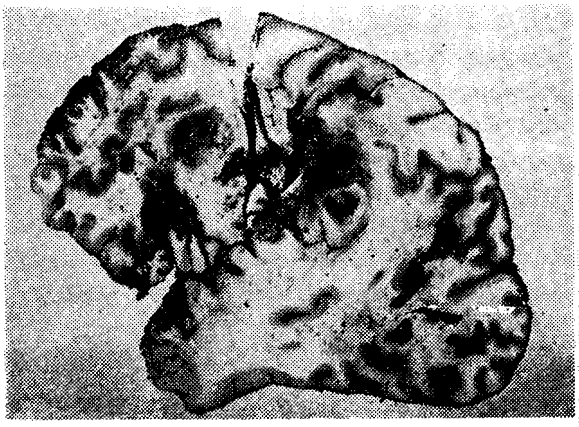
(本論文의 要旨는 檀紀 4292年 10月 11日 第11回 大韓醫學協會, 綜合學術大會 外科分科學會에서 發表하였음)



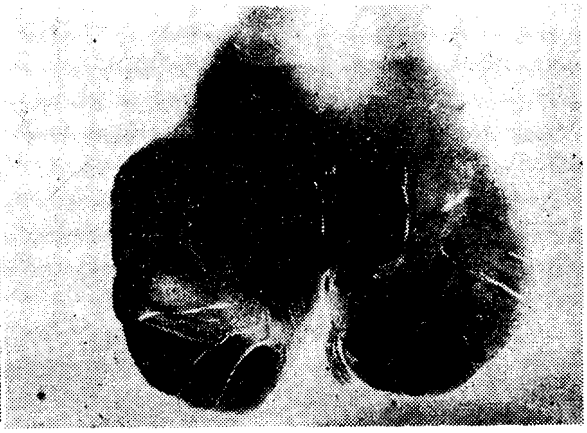
〈**Fig. 1**〉 Lateral aspect of the removed right cerebral hemisphere



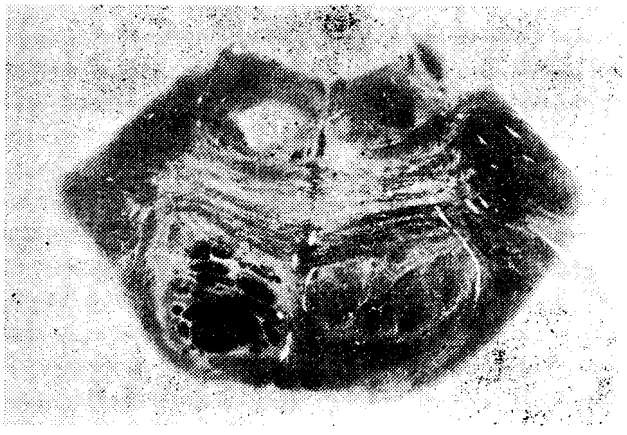
〈**Fig. 2**〉 Medial aspect of the removed right cerebral hemisphere.



〈**Fig. 3**〉 Sectioned surface of the removed right cerebral hemisphere.

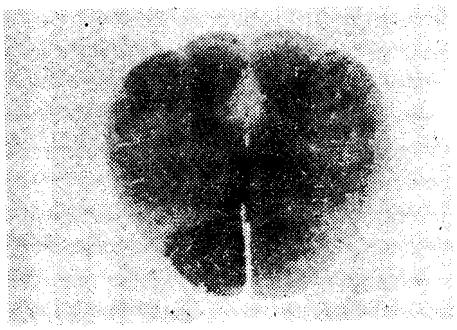


〈**Fig. 4**〉 Section immediately below the exit of the oculomotor nerve.



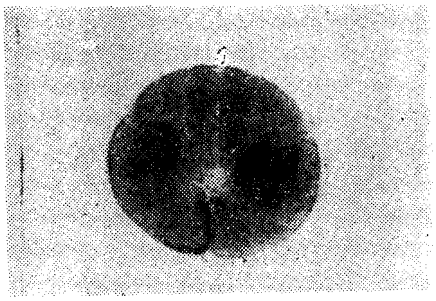
〈**Fig. 5**〉 Section through the exit of the trigeminal nerve.

〈**Fig. 6**〉 Section at the midportion of the inferior olivary nucleus

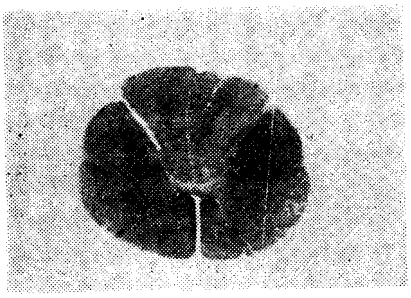


〈**Fig. 7**〉 Section through the obex.

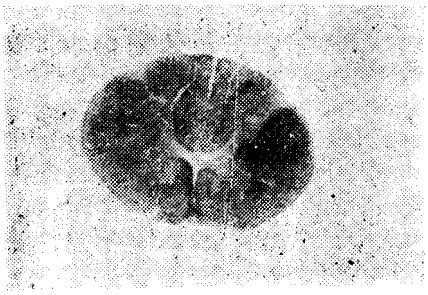
〈**Fig. 8**〉 Section at the pyramidal decussation.



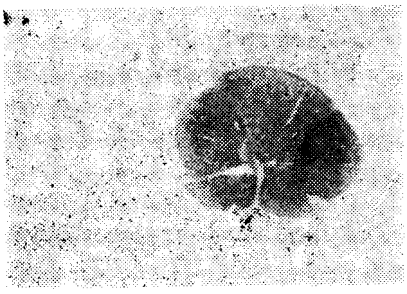
〈**Fig. 9**〉 Section at the C_1 level.



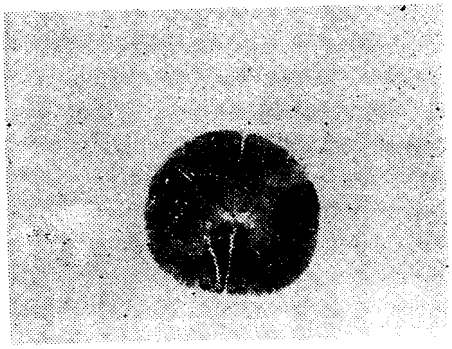
〈**Fig. 10**〉 Section at C_4 level.



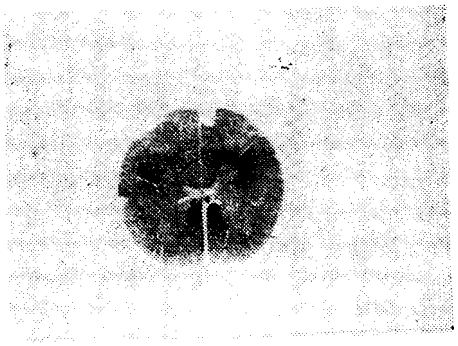
〈**Fig. 11**〉 Section at the C_7 level.



〈**Fig. 12**〉 Section at the midthoracic level.



〈**Fig. 13**〉 Section at the L_5 level.



〈**Fig. 14**〉 Section at the S_1 evel.