The Unforgettable Neurosurgical Operations of Musicians in Last Century

Dr. rer. med. Mag. phil. Elena Romana Gasenzer (1)
Ayhan Kanat, MD, Assistant Professor (2)
Univ.-Prof. Dr. Prof. h.c., Edmund Neugebauer (3)

1-Universität Witten/Herdecke, Campus Köln-Merheim, Köln, Institut für Forschung in der Operativen Medizin, Fakulty of Health, Department of Medicine, Germany

2- Recep Tayyip Erdogan University, Medical Faculty, Department of Neurosurgery, Rize-Turkey

3- Witten/Herdecke University, Dean of Medical School Brandenburg Theodor Fontane & Senior-Professur of Health Services Research, Universität Witten/Herdecke, Fakulty of Health, Department of Medicine, Campus Neuruppin, Germany

Corresponding Author 1: Elena Romana Gasenzer
Universität Witten/Herdecke, Campus Köln-Merheim, Köln,
Institut für Forschung in der Operativen Medizin, Fakulty of Health, Department of Medicine
Phone: 0221-989-57-0
Mail: elena.gasenzer@uni-wh.de
elena-romana.gasenzer@gmx.de

Corresponding Author 2: Ayhan Kanat, MD, Recep Tayyip Erdogan University, Medical Faculty, Department of Neurosurgery 53100 Merkez Rize Turkey,

Mail to: ayhankanat@yahoo.com Phone: 90 5065855139 Fax 90 464 2140497
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Abstract:

Background: there is no study for interesting craniotomies of famous musician in history. This subject was investigated.

Material and Methods: The key words were “neurosurgery and music” and the names of composers. We used digital catalogues like “pubmed” as well as the libraries of universities.

Results: We found four musicians with different neurological diseases who are Maurice Ravel, George Gershwin, Clara Haskil, Pat Martino from the 20th century eras.

Conclusion: Neurosurgical disease was leaded poor to the end of a musical career and their lives in two of four musicians. Neurosurgeons today can understand the effect of limited diagnostic tools such as MRI and CT at the time on the poor outcome of two musicians.

I. Introduction

The brain is the locus of memory, compassion, logic, identity, and art. The practice of surgical manipulation of the nervous system and its coverings has been evident for more than 12,000 years, and the settings in which these practices have been conducted, have reflected the state of the art, science, and, indeed, purpose of these endeavors. However, at the beginning of this century, neurosurgery was in its infancy as a surgical specialty. Today the techniques and methods of neurosurgery are on a very high level. With the development of modern diagnostic methods like CT, MRT or fMRT it is possible to discover neurological disease in its early state. Disorders of the central and peripheral nervous system affect the famous musician at some time during their lives with remarkable consequences their craniotomies for the quality and outcomes of those lives. Overall, in terms of neuroscience, musical activities of musicians are considered equal in terms of memory as well as perceptive, cognitive and motor functions. However, there is no study for interesting craniotomies of
famous musician in history, so we wanted to know what chances have musicians after neurological surgery to continue their musical activities.

II. Material and procedures

Methods were general biographical information, historical investigation, and general research. Material was evaluated for historical and medical importance. The key words were “neurosurgery and music” or and the names of composers. We used digital catalogues like “pubmed” as well as the libraries of universities.

Results;

III. Neurosurgical cases from Music History

We found 4 musicians with neurosurgical disease in the 1930's to 1980's, they should have said so. The cases of Maurice Ravel, George Gershwin, and Clara Haskil are good examples of case reports of a neurosurgical operation in the first half of the 20th century. These case reports document the possibilities of neurosurgical treatment in the middle of the 20th century as well as the effects of neurological diseases on musical activities and performance. There are many speculative cases. For example, the finding of a temporal fracture on Mozart's skull gives a way to speculations about the possibility of a chronic subdural hematoma and its compressive effect on the temporal lobe. But, Mozart was not operated for his disease, for that reason, we did not include in this paper.

IV. The Craniotomies of George Gershwin, Maurice Ravel, Clara Haskil, and Pat Martino

IV. 1. The right temporal glioblastoma multiforme of George Gershwin

(1898-1937)

Medical History:

George Gershwin; The “Rhapsody in Blue”, piano concerto in F and his opera “Porgy and Bess” are his most famous works. In February 1937 during a concert in Los Angeles, Gershwin had a focal seizure. He lost consciousness for a few seconds when he played the
“Concerto in F”. After June 1937 his condition became worse. Gershwin was listless and apathetic. He had strong headaches, ataxia and photophobia. On Wednesday, June 23, Gershwin was brought to the Hospital, but the results of all medical examinations were normal. One evening, he was unable to walk. He had chronic headaches and smelled burned rubber. On the 9th of July he collapsed when he went to the bathroom Gershwin was brought to the Hospital again. He fell into a coma.

**Surgical procedure:** Friends of Gershwin searched a neurosurgeon, immediately called pioneering neurosurgeon Dr. Harvey Cushing in Boston, who, retired for several years by then, recommended Dr. Walter Dandy, who was on a boat fishing in Chesapeake Bay with the governor of Maryland. Friends of Gershwin then called the White House and had a Coast Guard cutter sent to find the governor's yacht and bring Dandy quickly to shore. His friends then chartered a plane and flew Dandy to Newark Airport, where he was to catch a plane to Los Angeles; however, by that time, Gershwin's condition was judged to be critical and the need for surgery immediate. At 3 o’clock the doctors performed a lumbar puncture; it showered a pressure of 500 mm H₂O. The spinal fluid was colorless and contained 30 mg of protein. Also one cell was found. The intracranial pressure was be lowered from 400mm H₂O to 220mm H₂O. Gershwin's condition became a little bit better, but a short time later he had bilateral Babinski-signs. The Neurosurgeons Dr. Carl Rand, Dr. Eugene Ziskind, and Dr. Howard Nafziger began with the operation a short time after midnight. The operation took five hours. The tumor was removed but it was a glioblastoma multiforme. After the operation, Gershwin stayed out of consciousness and his body temperature increased to 41° C. He died on July, 11, 1937. W. E. Dandy wrote there was no chance for Gershwin to survive, because it was impossible to remove a glioblastoma completely.

**Diagnosis:** The fact Gershwin died on a glioblastoma multiforme documented. After dura opening digital and visual examination were the only possibility to localize the tumor at
that time, before MRT and CT scans era. What makes a GBM probable in Gerschwin’s case is the short acute course, from the first psychiatric symptoms like, being nervous, feeling lonely, depressions and listlessness in 1936, to his first epileptic seizure on 11 February 1937. This seizure occurred when Gershwin practiced with the Los Angeles Philharmonic Orchestra. During the concert in the evening of the same day, a further epileptic seizure occurred when conducted his Concerto for piano in F-major. He played the solo part himself as soloist. He suffered a petit-mal-seizure, lost his consciousness for 10 to 20 seconds, and missed several bars of his piano solo. No spasmodic jerks occurred. A few seconds after that he continued playing and conducting on the right bar\textsuperscript{12,13,16,18}. There is no record about the impact of the disease on Gershwin’s musical performance, A special role plays Gershwin’s “composer’s stomach”: his occasional abdominal problems, and abdominal pain possibly may be symptoms of early focal seizures as a feeling of an epigastric aura.\textsuperscript{19,20} The epigastric aura is a typical symptom of temporal focal seizures without loss of consciousness. If the size of the tumor increased and surrounding brain structures are compressed the epileptogenic zone spread out\textsuperscript{20}. Mostly patients with low grade gliomas suffered from tumors associated epilepsy\textsuperscript{20-22}.

IV. 2. The fatal craniotomy of Maurice Ravel (1875-1937)

Medical History: Maurice Ravel was one of the great composers of expressionism. At the the early age of 25 he became famous\textsuperscript{23-25}. In 1927 friends reported that Ravel had difficulties to write\textsuperscript{24}. In 1929, he had an accident with a taxi and had some injuries and a brain concussion\textsuperscript{26}. After the accident, his health became worse.\textsuperscript{27} During a trip to the coast in 1933, he had motor disturbances when he swam. It was apparently that symptoms of neurologic disorder of Ravel developed, which affected the motor system and also his cognitive abilities\textsuperscript{28}. Since that time, he had great difficulties to write, ataxia, and motor aphasia\textsuperscript{29}. 
**Surgical Procedure:** In the autumn of 1937, his condition became dramatically worse. The surgeon Thierry de Martel recommended a neurosurgical operation\(^{30}\). On 17\(^{th}\) December, Ravel was brought to one Hospital. The Neurosurgeon Dr. Clovis Vincent (1879-1948) and the neurologist Alajouanine suspected either a brain tumor or hydrocephalus. Clovis Vincent (1879-1948) was the founder of neurosurgery in France\(^ {31}\). On 19th December, Dr. Vincent performed a right frontal craniotomy\(^ {32}\). But he could not find a tumor. The brain tissue looked normal, and there was no atrophy\(^ {33}\). A few hours after the operation, Ravel woke up and called for his brother. Later he fell into coma. He died in the morning on the 28th of December.

**Differential Diagnosis:** The exact diagnosis of Ravel’s disease is not known\(^ {34}\). Some authors diagnosed a traumatic hydrocephalus, Pick-Disease, a Wiplash syndrome\(^ {35}\), Alzheimer’s disease\(^ {36}\) or a corticobasal degeneration\(^ {37}\). Some musicologists believe the special style in his last works, specially the Boléro, are a symptom for his amusia and neurologic disease\(^ {38}\), because the Boléro is “Music with nothing”\(^ {32}\). Amusia is occasionally a consequence of brain damage, and often is coupled with aphasia. It is notable in the case of the Russian composer V.Y. Shebalin (1902–1963), who continued to compose after a left-hemisphere stroke causing hemiplegia and severe aphasia\(^ {39}\). He worked with very reduced musical material and the orchestra repeat only the same theme. The only enhancement in the musical expression will be reached with loudness and the instrumentation\(^ {23}\). His difficulties to write go with his special expression in his last works. Because of a brain injury or disease, the disability of writing may occur, without lost of musical abilities\(^ {24}\). Also the role of the asymmetry of the hemispheres was discussed\(^ {40}\). Special the right hemisphere should be preferred to process musical patterns. Some authors developed the theory that Ravel’s illness would have affected primarily the right hemisphere\(^ {41}\). A broad range of events and factors can lead to a wrong-site craniotomy\(^ {32,42}\). Probably, the most dramatic wrong-site craniotomy in the neurosurgical literature. Many of these preoperative checks had been done before the
deadly a wrong-site craniotomy performed on Maurice Ravel by Clovis Vincent. Although the opinion of doctors and his friends was divided, it was decided that it was better to try to do something to rescue him rather than to let him continue as he was\textsuperscript{32,42}. Before the craniotomy, Ravel’s friends did not want him to be frightened when his hair was to be cut off for the intervention, and they suggested that this was another radiologic examination. The composer was clearly aware of what was going on, saying, “Not at all: I know exactly that they will cut off my head.” Ravel underwent an exploratory craniotomy. After the surgery, Ravel lapsed into coma, and on December 28, 1937, he died\textsuperscript{32,42}

IV. 3. The first awake craniotomy in music history; The suprasellar tumor surgery of Pianist Clara Haskil in 1942\textsuperscript{43,44}

Medical History: Clara Haskil (1895-1960) became famous because of her wonderful interpretations of Mozart’s piano concerts\textsuperscript{45}. Her style and the expression of her piano playing are also today a standard of high level piano playing\textsuperscript{46}. In her youth Clara Haskil suffered from congenital scoliosis, which deteriorated seriously during her years at the Conservatoire. She had to give up the violin for this reason as early as 1914. In the same year her uncle sent her to a famous nursing home for bone diseases in Berck-sur-Mer\textsuperscript{47}. In 1942, she complained about strong headaches and impaired vision. Based on headache and bitemporal hemianopsia, several doctors diagnosed a brain tumor.

Surgical Procedure: Awake craniotomy with local anaesthesia. The Parisian Neurosurgeon Dr. Marcel David (1898-1986) performed a right-sided craniotomy on Clara Haskil\textsuperscript{3} under local anaesthesia within four hours and without complications\textsuperscript{48}. Until 1939, Marcel David an assistant of Clovis Vincent at the Pitié. She had no neurological problem(s) after this surgery. It’s not known whether Dr. David always used local anaesthesia in such surgery or as a general rule used available sedation techniques\textsuperscript{2,48-50}. Since the end of 19th century chloroform anaesthesia was standard for surgical interventions of any kind\textsuperscript{51}. later
nitrous oxide was preferred. Because of the World War II and the occupation by the Germans, the medical care was difficult in France 1942. Therefore, it cannot be assumed that Dr. David had the latest techniques of anesthesia and surgical management available. Possibly Marcel David used a sedation with nitrous oxide to open the skull, and performed the intervention under slight sedation or local anesthesia due to a lack of material and equipment. Clara Haskil played mentally Mozart’s piano concerto in E-flat Major KV 271 throughout the operation 47, to test her memory as well as a distraction. Some studies shown, that Mozart’s music has positive effects on brain functions, called Mozart effect. After listening of Mozart’s sonata in D-Major for two pianos (KV 448) blood pressure was lower and the IQ temporarily rise up about 8 or 9 points 52,53. In a group of 29 patients with epileptic seizures, in 23 cases the epileptiform activity decreased. In one comatose patient with status epilepticus the amount of ictal activity decreased from 62% to 21% during listening Mozart’s piano sonata D-Major KV 448. 54,55 To “play” the Mozart piano concerto E-flat Major KV 271 mentally by heart. The case report Clara Haskill is the first reported awake craniotomy of a famous musician 44. Today as well as in the past awake craniotomies were performed, when it is to hazardous for the patient to perform general anesthesia 56,57. Specially when the tumor is located in frontal lobes, language or memory areas, near the motor cortex, or in case of epilepsy surgery awake craniotomy is a safety method to preserve high functional areas by a most completely removal of the tumor or epileptic focus 58.

**Differential Diagnosis**

Since 1942 Clara Haskil complained of headaches which grew in frequency and intensity, accompanied by impaired vision. Because of her headache and bitemporal hemianopsia, several physicians finally diagnosed a brain tumor, mostly a pituitary tumor. Headaches and increasing visual impairment are a characteristic symptom of a suprasellar tumor as well as a tuberculum sellae meningioma pressing on the chiasma.
opticum. Headaches are a sign if the tumor has grown to a certain size. Clara Haskil often suffered severe headache, so it’s probably that she suffered by chronic headache. A supra- or parasellar tumor can cause cluster headache because of increasing intracranial pressure, cerebrovascular problems, neuro-endrocrine changes or an activation of the trigemino-vascular system. Pituitary tumors may also provoke hormone disorders. Specially a influences the secretion of pituitary hormones such as ADH or TSH, prolactin. In the case of Clara Haskil is unlikely because she hadn’t symptoms of hormone disorders. Other differential diagnosis would be a Rathke cleft cysts, which may also be located in the sellar and suprasellar regions and may produce symptoms like headache, visual loss, and/or endocrine dysfunction. Craniopharyngiomas can spread along an axis from the third ventricle to the pituitary gland, but they are a typical non-glial brain tumor of childhood (6 - 8% of all pediatric brain tumors) Thus makes a craniopharyngioma in case of a 47 years old woman unlikely.

**Traumatic brain injury, and skull fracture of Clara Haskil**

On 6th December 1960, Clara Haskil went to a concert in Brussel. On the stairs at the Brussels central-station she fell down and bruised her head on a stair. For short time, she lost consciousness. They brought her to a hospital, a few hours later to another one. There, she was diagnosed with a head trauma with skull fracture and an intracranial hemorrhage. She lost consciousness again. Doctors performed a trepanation. Clara Haskil died six hours later in the early morning hours of December 7, 1960. The short course is typical of such accidents. She was able to speak and she expressed a fear she might have injured her hands. Briefly, she regained consciousness, and orientation. She lost consciousness again at the second hospital she was taken. Her condition deteriorated dramatically. The “lucid interval” is a distinctive sign of epidural haematoma. It is at least as likely to accompany a subdural as an epidural hematoma.
There is no documentation of the surgery, which Dr. David performed on her in 1940, possibly lost in the turmoil of war. Some documents about her medical treatments received are in private hands today. Increased intracranial pressure or brain edema may be causes of her death.

**IV. 4: AVM Surgery of Pat Martino**

Pat Martino was born in Philadelphia in 1944. He started playing guitar when he was 12 years old. He left school at that age to pursue a music career. Before his 18th birthday, he became an icon in the jazz scene, signed as a leading artist for Prestige Records at age 20. His key albums during this period included “Strings!,” “Desperado,” “El Hombre,” and “Baiyina,” one of the first successful jazz ventures in psychedelic music. This musician underwent surgery to treat an intracerebral hemorrhage resulting from a cerebral arteriovenous malformation, requiring a wide left temporal lobectomy. Before surgery, Pat Martino had a history of epilepsy associated with manic depression but no abnormalities in his musical capabilities. After surgery, he had an almost complete memory loss, showing the expected effect of an extensive injury to the left temporal lobe. He completely lost his musical capabilities including theory, technique, and skills. However, the musical capabilities of Pat Martino completely recovered even when much of the left temporal lobe has been removed.

**Big Tragedy of a Picture**

Picture 2 shows a scene from birthday party honoring Maurice Ravel in New York City, March 8, 1928. From left: Oskar Fried; Éva Gauthier; Ravel at piano; Manoah Leide-Tedesco; and George Gershwin. The cases of George Gershwin and Maurice Ravel demonstrated the first cases of neurosurgical treatment in music history. Both died

VI Discussion:

What we have learned from Unforgettable craniotomies of famous musician in last century?

Unfortunately, in Ravel’s, Gershwin’s, Haskil’s day there were no modern neuroimaging methods, such as CT, MRI, functionalMRI, SPECT, or PET. “What is the worst that could happen if neurosurgeons do something? What is the worst that could happen if neurosurgeons do nothing?”42. Those were likely questions of their surgeon. Today, neurosurgical practice is confronted by an explosion of technology80-83. Only neurosurgeons can understand the feelings of neurosurgeons in that time, who had limited diagnostic tools. At that time of Ravel and Gershwin, neurosurgical operations were risky for the patient2. The first medical textbooks about neurosurgical techniques and procedures were published between 1930 and 1950 by the pioneers of neurosurgery84 like, H. Cushing85, W. E. Dandy86 or P. Bailey87 in USA as well in Europe. The case of Clara Haskil is very interesting44.

She had her first operation in the middle of the 20th century when operation microscope and microsurgery were not available. Her tumor was possibly a meningioma of the suprasellar region. Perhaps Dr. David used the method by Krause or Frazier of a right-frontal trepanation88. She recovered completely. Her great career as a pianist began after this surgery. But she died after a second operation in 1960 when modern neurosurgery had begun3,89.

What about the surgery of jazz guitarist Pat Martino?

Pat Martino underwent a left temporal lobectomy in 1980. After surgery, he presented with severe retrograde amnesia and complete loss of musical interest and capabilities. His musical abilities, including theory, technique, and skills, were completely lost. It is known that
musicians use the left hemisphere more; The patient’s musical abilities recovered overtime, and he regained his previous virtuoso status. The surgery of Pat Martino shows the possibility of an unusual degree of cerebral plasticity and reorganization of professional musicians. Musicians with enhanced motor skills possess greater capacity for plasticity because of enriched interhemispheric connections and structural asymmetry of relevant brain areas. It is known that musicians use the left hemisphere more. This knowledge favors that the asymmetry of the left planum temporale is slower than in the general population. This “symmetry” of his hemispheres related to music exposure possibly influenced the recovery and further development of musical abilities in Pat Martino.

**Limitations:**

This review faces important limitations. Firstly, we could only investigated the musician, which appeared in literature. It is obvious, that many musicians who were operated but not appeared in literature. Secondly, we aware that, in this paper, there is only a spotty discussion of how each of the musicians’ musical prowess was affected by her/his disease. The aim of study is uncover the interesting craniotomies of famous musicians, not affection musical prowess by neurological disease. In future, we want to write an article about this subject.

**Conclusion:**

The neuronal plasticity of musician’s brain may be different than nonmusician. The successful cranial surgery of Pat Martino and Clara Haskil may be example for recovering damaged functions of brain of musicians. Our review will lead to remember these interesting craniotomies in future. It will lead to publish more case report in this subject, and open new horizons of about recovering of musician after neurosurgery.

**Competing interests:** The authors declare that they have no competing interests.
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Legends

Picture 1: Clara Haskil (7 January 1895 – 7 December 1960) was a classical pianist, renowned as an interpreter of the classical and earlyromantic repertoire.

Picture 2 shows a scene from birthday party honoring Maurice Ravel in New York City, March 8, 1928. From left: Oskar Fried; Éva Gauthier; Ravel at piano; Manoah Leide-Tedesco; and George Gershwin.
Abbreviations:

**CT:** computed tomography

**fMRT:** functional Magnetic Resonance Tomography

**MRI:** Magnetic resonance imaging

**PET:** Positron emission tomography

**SPECT:** Single-photon emission computed tomography