Historical Vignette

Hans Sølling: Danish pioneer neurosurgeon

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Hans Adolf Sølling (1879–1945), working completely on his own in the small town of Horsens, was Denmark's first neurosurgeon. Sølling was an admirable and talented man who performed major intracranial operations on more than 130 patients suffering from trigeminal neuralgia, as well as treating epilepsy, cranio-trauma, brain tumors, glossopharyngeal neuralgia, and myelomeningoceles. Although not in the same league as Harvey Cushing (1869–1939), Vilhelm Magnus in Norway (1871–1929), and Herbert Olivecrona in Sweden (1891–1980), Sølling was a true Danish pioneer.

KEY WORDS • Hans Sølling • Harvey Cushing • neurosurgical history

Olof af Acrel (1717–1806), surgeon-in-chief at the Royal Serafimer Hospital in Stockholm for an unprecedented period of 54 years in the 18th century, was an early forerunner of Herbert Olivecrona (1891–1980), who founded Swedish neurosurgery in the same hospital during the period 1922–1960. In Finland, Carl Daniel von Haartman (1791–1877), who was appointed chief surgeon in 1817, successfully operated on patients suffering from head injuries associated with dural lacerations, and also performed surgery for “dural sarcoma” and spina bifida. In Norway, there were a few forerunners to Vilhelm Magnus (1871–1929), who himself founded Norwegian neurosurgery. Among these pioneers in the Nordic countries, there was a neurosurgeon who worked alone in the small town of Horsens in Denmark. His name was Hans Adolf Sølling (1879–1945).

Forerunners in Danish Neurosurgery

In 1885, Joachim Bondesen (1852–1908), working at the Copenhagen municipal hospital, presented operative results in two patients on whom he performed a craniotomy following severe head trauma. He rightly suspected that bleeding from the middle meningeal artery had resulted in an epidural hematoma in the first patient, who was in deep coma immediately prior to surgery. The operation was undertaken 2 hours after hospital admission and the patient did not survive. Bondesen believed that this individual might have survived if surgery had been performed an hour earlier. The second patient had suffered complicated skull fractures with brain laceration following an industrial explosion. Bondesen carefully removed all bone fragments, foreign material, and lacerated brain tissue. The procedure took 3 hours and the postoperative course was uneventful. At follow-up examination 2 years later the patient considered himself fully recovered. Bondesen concluded: “Despite the many and severe lesions with loss of a considerable volume of brain tissue, the postoperative course was remarkably smooth and the lesion did not result in obvious signs of persistent cerebral malfunction.”

In April, 1894, Peter Wilken Heiberg (1840–1920), working at a local hospital in the town of Viborg, operated on a 23-year-old woman who had presented with Jacksonian epilepsy followed by progressive right hemiparesis and increasing headaches. Heiberg explored the upper part of the fissure of Rolando where he noticed a bulging brain. He incised the cortex and found a cystic lesion with brownish detritus. The cyst was emptied and the thickened walls of the cavity scraped with a sharp spoon. At follow-up examination 9 years after surgery, the patient was alive but still suffering from Jacksonian epilepsy. In 1900, Heiberg operated on a middle-aged woman with a history of Jacksonian epilepsy and increasing headaches. He performed a two-stage procedure and was able to enucleate a glioma. At follow-up review 2 years later, the patient
was in fairly good condition without disabling focal motor deficits.

At the Copenhagen municipal hospital in 1905, Eilert Adam Tscherning (1851–1919) performed a two-stage operation with radical extirpation of a left convexity meningioma behind the fissure of Rolando in a 49-year-old man with increasing dysphasia and Jacksonian seizures. At follow-up evaluation 20 years later, the patient’s only deficit was a slight spastic paresis of the right upper limb, which did not prevent him from leading a full working life.

The first operation on a spine tumor in Denmark was performed in 1909 by Vilhelm Hertel (1861–1918), working in the small town of Fakse. His 85-year-old operative report would not differ from any similar report of today. The operation took 1½ hours, during which an intradural tumor, which compressed the cord to the left over a distance of 2 cm, was completely removed. Microscopy showed it to be a “fibromyxoma” and the patient enjoyed good health for more than 20 years after surgery. Hertel seems to have been worthy of the final sentences in a 1910 paper by Percival Bailey on surgery of spinal cord tumors: “Few operations offer a greater opportunity for a surgeon to show his handicraft. All cases should be left to those known to have both strength and delicacy of touch as well as accuracy and speed.”

Vilhelm Schaldemose (1866–1933), who was appointed chief of surgery at the Rigshospital in Copenhagen in 1906, showed an early interest in the operative treatment of brain and spinal tumors. Patients with such afflictions were invariably referred to him by neurologists, in particular by Viggio Christiansen (1867–1939), Denmark’s first professor of neurology. Schaldemose’s involvement in neurosurgery began in July, 1911, when he performed his first major elective intracranial operation. The patient was a 59-year-old man who had been diagnosed as suffering from trigeminal neuralgia by the neurologist August Wimmer (1872–1937), who considered surgical treatment the only option. Schaldemose followed the advice of Dr. Wimmer and performed a resection of the gasserian ganglion according to the technique of Fedor Krause, with a very good result; the patient was pain-free at follow-up examination 20 years later. In the years to come Schaldemose performed surgery on another 14 such cases.

Schaldemose was not inclined to publish the results of his operative procedures, and the only part of his clinical material that has been collected as a whole is his series of spine tumor operations. An eminent surgeon of few words, Schaldemose was as exceptionally careful in the operating theater as with his patients. He had an inspiring influence on his staff but was not always an easy man to work with because of his high standards. One of his pupils, Eduard Busch (1899–1982), was appointed Denmark’s first professor of neurosurgery in 1948. An earlier pupil, Hans Adolf Sølling, adopted and developed Schaldemose’s main fields of interest.

The Case of the Blind Brushmaker’s Son

In the town of Horsens in Denmark lived a blind brushmaker with eight children. The fourth child to be born was a boy named Villy, who was an adventurous and enterprising young fellow. At the age of 6 years, Villy was knocked down by a car and had to remain in bed for some time; following this accident, he was troubled by nocturnal urinary incontinence. Later, after attending a visiting circus and watching the performers, Villy decided to try his luck as an artist. He stretched a sailcloth over four wooden poles planted in the ground and invited the neighborhood children to attend his little circus performance at the cost of 2 øre (less than half a cent). He then climbed up 5 m and jumped. Unfortunately the sailcloth did not withstand his body weight and he pierced the sail and landed on his heels, thus sustaining a severe axial trauma to the lumbosacral spine. Whether he had to stay in bed after this accident Villy did not remember, but probably he was afraid to tell his parents about his acrobatics. Somewhat later, Villy, armed with a large umbrella, attempted parachuting, which resulted in a trauma similar to that of his circus act.

The brushmaker in 1933 acquired a new family doctor, but he was most suspicious: “Can that young chap think out anything by himself?” That was unjust. The young physician knew his literature and was aware of the fact that enuresis nocturna in children was often associated with spina bifida occulta. He arranged for an x-ray film of Villy’s back and, since this examination confirmed what he had suspected, Villy was admitted to the local hospital in Horsens.

The chief of surgery in the hospital was an eminent surgeon named Hans Adolf Sølling (Fig. 1). After due consideration, Sølling decided to operate on Villy. Prior to surgery it was noted that there was a dextroconvex scoliosis of the lumbar spine. There was some tenderness upon local pressure on the midlumbar area. The operation was performed under general ether anesthesia on February 1, 1934. Sølling, via a curved incision, explored the posterior aspects of the lumbar spine and removed the rests of the laminae corresponding to the midline bone defect, whereupon he discovered a well-circumscribed, firm, and fibrous mass that he was able to remove completely. Following this procedure, the dura started to show normal pulsations.

Villy made an uneventful recovery, was discharged from the hospital 2 weeks after surgery, and, most important, he was cured of his urinary incontinence. This was 7 months prior to the publication of the classic paper by Mixter and Barr on “Rupture of the intervertebral disc with involvement of the spinal canal.” At the age of 15 years, 6 months after his operation, Villy decided to go to sea; however, there were some difficulties involved in this decision. First, he had to procure a shipping-aboard permit, but to obtain that he needed his parents’ signatures. Since he did not want to reveal his plans, Villy himself signed the documents. He barely eluded detection by declaring to the authorities that his mother’s script was decidedly childish. Villy got his own way and in the 44 years to come,
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Fig. 1. Dr. Hans Adolf Sølling while chief of surgery at Horsens Community Hospital, 1915 to 1945.

all the oceans were his home. He got on well and was rarely ill. When Villy was examined 58 years after the successful operation, he gave a detailed account of it and added the accidents he had experienced as a young boy, which were not documented in the hospital journal of 1934.18 Since surgery, he had experienced neither back problems nor urinary incontinence. On examination there was a remaining lumbar scoliosis, absent left Achilles reflex, reduced left foot flexion, and slightly diminished anal sphincter tone.

Who Was Hans Sølling?

Hans Adolf Sølling was Denmark’s first neurosurgeon in the sense that he was the first surgeon who worked alone without the assistance of a neurologist. In the words of Harvey Cushing:4 “Whatever his specialty may happen to be, it is only when a surgeon is shouldered with the responsibility of acting largely on his own diagnoses that he will be impelled seriously to study his own cases before they come to the operation table and will be inclined to follow the results of his procedures to the end to see wherein his mistakes can be rectified on subsequent occasions. On no other basis will he be likely to see all round his subject.”

Sølling was born on April 19, 1879, in the county of Scania in southern Sweden. His parents had come from Denmark to Sweden where they leased a farmstead called Ettarp. In 1883, Sølling’s father died of acute appendicitis. It was not an easy task for the 28-year-old widow to be left with three small boys, and after some time she had to leave the farm and return to Denmark, where in 1894 Hans Adolf, the eldest, entered high school in the town of Randers. Sølling easily passed his final school examinations in 1898 although he experienced some difficulties in expressing himself in perfect Danish since he had grown up in Sweden. He was not fond of those teachers who quibbled and in his later life always found pragmatic individuals utterly boring. His children always found support from their father when in dispute with a teacher.

Sølling subsequently began studying medicine at Copenhagen University where his teachers in the preclinical years included Professor Christian Bohr (whose son was the Nobel Prize winner Niels Bohr, and whose grandson Aage Bohr was also a Nobel Prize winner) in physiology, Professor Hans Christian Gram (who developed Gram staining) in pharmacology, and Professor Jens Chievitz in anatomy, who came to exert a major influence on Sølling. Chievitz, a most respected and cherished teacher, was endowed with an extraordinary talent in drawing and reproducing exact anatomical details. This attracted Sølling, who soon became associated with him as a teacher of anatomy. With the salary from this spare-time occupation he was able to finance not only his own studies but also those of his two younger brothers, one of whom became an architect and the other an engineer. Sølling never abandoned his devotion to anatomy and, when confined to bed in his last months suffering from cancer of the stomach with multiple metastases, he produced anatomical drawings for his youngest daughter who by then had begun the study of medicine.

Sølling obtained his medical degree in June, 1905, in Copenhagen. After his graduation, he spent nearly a year as a lecturer in anatomy and was then assistant surgeon in different hospitals in the Danish capital. In June, 1908, he started his career as a surgeon at the Royal Frederiks Hospital, which was to become the Rigshospital in 1910. There seems to have arisen a special fellowship between the chief of surgery, Dr. Vilhelm Schaldemose, and his young pupil who was soon to adopt the ideas and techniques of his master. Sølling’s devotion to him is evident in the obituary he wrote after Dr. Schaldemose’s death in 1933.26

Since Sølling was involved in the treatment of Schaldemose’s first operation for trigeminal neuralgia, that technique soon became one of his prime interests. His medical dissertation,24 “Clinical studies on the etiology, pathophysiology and treatment of Basedow’s disease” in June, 1916, was well received. By then Sølling had taken up an appointment as chief of surgery at the local hospital in Horsens, Jutland. At that time the hospital had 100 beds with 330 operations per year.

Establishing Neurosurgery in Horsens

During his early surgical training, Sølling’s interest in diagnosis and surgical treatment of trigeminal neuralgia as well as brain tumors and craniotomy had been aroused. While Schaldemose always had a neurologist to evaluate patients and make preoperative assessments, Sølling now found himself completely on his own.
One month after his arrival in Horsens, Sølling was able to help an elderly man with long-standing trigeminal neuralgia by performing a resection of the maxillary branch. Five years later he was consulted by Hedvig, a young woman who suffered from recurrent trigeminal neuralgia despite undergoing multiple surgical interventions including opening the maxillary sinus and, later, resection of all peripheral branches of the fifth cranial nerve. Sølling noted in the case record that the patient’s intolerable trigeminal neuralgia justified the risks of a major intracranial surgical intervention. Hence he explored the gasserian ganglion with resection of the third branch in May, 1921. In February, 1921, when Sølling presented his results in his first four patients subjected to intracranial extradural resection of the fifth nerve to the members of the Medical Society of Jutland, Hedvig was still free of pain. Unfortunately her neuralgia recurred in August, 1921, and in the following month Sølling again explored the ganglion and discovered that the third branch had not been completely resected. Hedvig was again temporarily helped but her pain soon recurred. Her agony would certainly have deterred some surgeons from performing further operative procedures but 2 months later, Sølling made a third intracranial exploration. This time he removed the lower portion of the ganglion intradurally and the operation was a success. At follow-up evaluation 10 years later, Hedvig was free of pain although she had oculomotor palsy and diplopia. Following Hedvig’s third operation, Sølling made it a rule in patients with trigeminal neuralgia to perform intradural explorations and resections in the manner of Frazier.

From 1920 to 1945 Sølling performed 136 gasserian ganglion operations on 121 patients. In 1932, the results in his first 53 patients were published, showing a 66% cure rate and a 15% mortality rate; however, in his last 68 patients the mortality rate dropped to 2.9%. The outcome of subtemporal trigeminotomy at the Aarhus University Hospital using Frazier’s method from 1943 to 1959 was documented in 1965. This was the same procedure that Sølling had used, and his results are compared with those from Aarhus in Table 1.

In February, 1933, a 61-year-old stevedore with intractable pain in his left ear came under the care of Sølling, who wrote: “The pain is paroxysmal and is elicited by talking, eating or chewing. The painful attacks occur daily and make living unbearable. Upon examination it is obvious that simple touch in the left part of the throat corresponding to the palate, tonsil and posterior base of the tongue elicits pain attacks whereas touch or pinch in the face does not bother the patient. Previous attempts to treat the illness with morphine and diathermia have had no effect. Since the condition is totally intolerable the patient begs for any surgical procedure that can offer him relief. He is thoroughly informed of operative risks and possible complications of surgery such as facial palsy, deafness, nausea and at worst heart standstill from vagus nerve injury.”

On March 8, 1933, Sølling performed a 3 × 4-cm left posterior fossa craniectomy under general ether anesthesia. An astute surgical anatomist, he had no difficulty identifying the jugular foramen and the glossopharyngeal nerve, which he resected. The patient was pain-free after surgery but had anesthesia corresponding to the ninth cranial nerve. Six years later Sølling presented this case at the spring meeting of the Medical Society of Jutland. The following day he was consulted by an otologist who had heard his presentation. The otologist had a 54-year-old male patient with similar symptoms and on 19 occasions had tried different local treatments in vain. After having carefully explained the risks involved to the patient, Sølling again performed a left posterior fossa craniectomy with resection of the glossopharyngeal nerve between the pons and the jugular foramen. After surgery the patient was free from pain but had a slight left facial palsy, deafness of the left ear, some hoarseness, and reduced power in left shoulder elevation. On discharge 2 weeks after surgery, the patient’s left facial function was almost completely restored.

### Hans Sølling and Foerster’s Operation

In 1917, Sølling undertook his first dorsal thoracic rhizotomy for “gastric crisis,” first described 8 years earlier by Foerster and Küttner in Breslau. He repeated this operation successfully in two more patients in 1920 and 1921. He also treated a 42-year-old goldsmith, who had contracted syphilis in 1902 and had suffered from “gastric crisis” since 1913. The painful attacks had increased in intensity as well as frequency, but following bilateral rhizotomy of the six distal thoracic sensory roots, the patient was completely relieved of his severe attacks, and had no motor deficits or sphincter disturbances. Much later, Professor Eduard Busch performed this operation in Copenhagen on the Danish author Karen Blixen, who suffered from syphilis and gastric crisis. By then Busch had visited Dr. Sølling in Horsens where he had learned much from his autodidactical neurosurgical experience.

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**Table 1**

<table>
<thead>
<tr>
<th>Factor</th>
<th>Horsens Hospital, 1920–1945</th>
<th>Aarhus University Hospital, 1943–1959</th>
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<tr>
<td>no. of cases</td>
<td>53</td>
<td>206</td>
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<tr>
<td>cured</td>
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<td>72%</td>
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<tr>
<td>complications</td>
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<td>1.4%</td>
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<tr>
<td>recurrent herpes</td>
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<td>12.1%</td>
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<td>fifth nerve palsy</td>
<td>15%</td>
<td>33%</td>
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<tr>
<td>reduced hearing</td>
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<tr>
<td>anesthesi dolorosa</td>
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<td>6.3%</td>
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Other Neurosurgical Achievements in Horsens Hospital

A study of 32 head-injured patients admitted to the surgical department of the hospital in Horsens from 1915 to 1927 revealed that Sølling had operated on seven of these cases. He had been able to diagnose and evacuate epidural hematomas in two children, with an excellent outcome in both. One of these children with an associated lesion of the superior sagittal sinus had bilaterally dilated and nonreacting pupils immediately prior to surgery.

In 1918, a 42-year-old convict with frequent focal left Jacksonian epilepsy was referred to Sølling's ward. At 10 years of age, the patient had sustained a head injury resulting in a depressed fracture in the right parietal region where there was a visible hollow. He had subsequently lost self-confidence and had fallen into bad company. Sølling explored and repaired the defect; following this successful operation the former convict was cured both of his epilepsy and his criminal behavior.

Six years later Sølling operated on a 14-year-old girl with disabling Jacksonian epilepsy (despite medical treatment with bromide), who, at birth by forceps delivery, had sustained an injury resulting in a 7 × 8-cm bone defect in the right frontoparietal region. At surgery he found an arachnoidal cyst and grossly thickened overlying dura. He drained the cyst and covered the cranial defect with bone and periosteum transplants from the left tibia. The girl had one attack of status epilepticus some time after surgery, then remained free from seizures and was able to stop medical treatment. In subsequent years, Sølling operated on two more patients with cranial defects who did not have seizures. In these cases he turned an outer flap consisting of periosteum and tabula externa to cover the defect.

Sølling diagnosed and subsequently operated on intracranial tumors but since the tumors were all malignant gliomas, it appears that he lost interest in the surgical treatment of such lesions. In 1936, a radiologist was appointed at the hospital in Horsens and subsequently a few patients with brain tumors received radiotherapy each year. Sølling also performed explorations of the spinal canal and spinal cord and operated on five patients with myelomeningocele, two of whom survived. He surgically divided a tendion of the sternocleidomastoid muscle in three patients with spastic torticollis and ligated the common carotid artery in one patient with pulsating exophthalmos. He performed neurolysis of the sciatic nerve in three patients with sciatica and resected a cervical rib in another. He also pioneered treatment of fracture dislocations of the spine, and described in detail two cases of odontoid peg fracture.

Hans Sølling: the Man

Like the Norwegian pioneer neurosurgeon Vilhelm Magnus, Hans Sølling worked alone and never sought an academic position. He was unobtrusive and when he did not agree with some matter under discussion, he preferred to remain silent in such a way that none doubted his real opinion. He was a polite and generous man and his home was always open to family acquaintances. Occasionally his guests would stay late and on such occasions Dr. Sølling's wife took over so that he could withdraw discreetly and go to bed punctually. He spent his vacation in September each year at the famous Brøndum's Hotel in Skagen (Fig. 2) at the tip of Jutland. He found it difficult to be away too long and usually cut his vacation short and returned to his department a couple of days early.

There is no doubt that Sølling's great knowledge of topographical anatomy combined with his excellent surgical skills were the cornerstone of his achievements. It would appear that until now, this pioneer Danish neurosurgeon has not been awarded the recognition he merits.

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