CONCERNING QUECKENSTEDT AND HIS TEST

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In the year 1916, Hans Heinrich Georg Queckenstedt published his important article “Zur Diagnose der Rückenmarkskompression” (Dtsch. Z. Nervenheilk., 1916, 55: 325–333). On the basis of this article the phenomenon described by him has been called Queckenstedt’s test. As is well known, it is performed as follows: with the patient lying horizontally on his side a lumbar puncture is made and the cerebrospinal fluid allowed to flow into an attached manometer. If one then compresses the jugular veins in the neck, the level of the fluid in the manometer rises, to fall at once when the pressure is released. If there is, in the spinal canal between the foramen magnum and the lumbar needle, an obstruction that partially or completely occludes the passage, the rise of the fluid following the compression of the veins will be partial or absent. This is called a positive Queckenstedt test.

One must recall that Queckenstedt’s discovery was made in that era following the introduction of lumbar puncture by Quincke (1895) in which intensive study of the pathology of the spinal fluid was pursued in all countries, especially in Germany. One learned to know the content of the fluid in cells and protein, especially globulin (Nissl, Nonne-Apelt, Weichbrodt, Pandy). Wassermann discovered his complement-fixation reaction in blood and fluid. A quantitative refinement of the latter made known by Hauptmann led to the introduction of the colloidal reaction by Lange in 1912.

Further the syndrome of compression or obstruction of the fluid by intradural or extradural tumors was described by Froin and Nonne. This phenomenon (increase in protein, usually xanthochromia and no increase in cells) Queckenstedt began to investigate more fully. He was astonished that the chemical and cellular properties of the liquid had been thoroughly investigated while its mechanical behavior had attracted little attention. The increase of the protein content of the fluid without increase of the cells he thought to be oedema of the fluid, corresponding to the stasis oedema of the spinal cord and dura mater, both of which would appear long before a true compression could be spoken of, since any pathological process outside or inside the spinal cord would be accompanied by a swelling (oedema) of the cord and its coverings. Queckenstedt had noted, early in the course of his numerous investigations, that the fluid in the manometer fluctuated with each respiration and that by straining and coughing the pressure immediately moved up and down. In what way he hit upon the maneuver of com-

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pressing the jugular veins is not evident from the original work, probably entirely from theoretical physical reasoning, which proceeded from the datum that an increase in the pressure within the cranium—as, for example, with tumors—would be visible also in the lumbar fluid, provided no hindrance in the spinal canal made the movement of the fluid and, therefore, its communication with the lumbar manometer impossible. Queckenstedt had, with great acuity, remarked that, in the presence of a block of the spinal canal, the rise of the column of liquid in the manometer was lacking, when one compressed the veins, although a rise still occurred by straining and coughing, whereas under normal conditions no significant difference could be observed between the effect of the straining and of the obstruction of the jugular veins. He concluded correctly from this that a congestion of blood occurred in the cranium from the obstruction of the cervical veins, that thus the room for the fluid was reduced, and that thereby it would be displaced by the resulting increase in pressure which was transmitted caudal-
wards with great speed, to become apparent in the manometer. In the
presence of a compression of the canal, on the contrary, the rise of the fluid
is delayed, incomplete or completely absent, and also following release of
the constriction of the neck the pressure sinks slowly or not at all.

It is apparent that the discovery of this phenomenon was of great value
for clinical neurology, especially for the diagnosis of processes that encroach
upon the spinal canal and impede the circulation of the spinal fluid within
the canal.

Doubtless also the discovery of Queckenstedt influenced studies of the
physiology of the spinal fluid. This began around the 20's and, especially
in the U.S.A., led to new, pioneering knowledge (Cushing, Weed, Dandy) of
the secretion and resorption of the fluid under normal and pathological con-
ditions. Modern neurosurgery, developed in the U.S.A., has profited in un-
foreseen ways and Queckenstedt was thus significantly concerned in its
triumphal progress.

Biographical data concerning Queckenstedt's life are scanty. We are in-
debted for most of them to his nephew, Dr. H. Queckenstedt. He was born in
Leipzig-Reudnitz on the fifteenth of August, 1876, the son of a teacher. His
ancestors were mostly farmers or teachers. His youth was rather penurious,
his father receiving a yearly salary of only 300 "Thalers." Since Quecken-
stedt, in his early years, showed evidence of superior gifts, every effort was
made to enable him to attend high school and university. In school he was
especially interested in natural sciences, physics and mathematics. His
aptitude for mathematics was such that his brother, who pursued advanced
studies in mathematics, whereas Queckenstedt had not, in later years sought
his help in the solution of specially difficult mathematical problems. His
love of natural science led him while a student, together with friends, to
undertake hikes through the woods in order to pursue botanical and zoologi-
cal studies and—through catching and later selling of vipers—to augment
his meagre financial resources.

Two of his best friends are still living—Prof. Hans Curschmann, the
internist in Rostock and Prof. H. Bittorf, internist in Leipzig, formerly in
Breslau. To these gentlemen we are indebted for many personal and medical
details concerning Queckenstedt. They remember him as a very able and
enthusiastic physician and investigator, as an absolutely dependable, up-
right and truthloving character. After finishing his medical studies at the
University of Leipzig he passed the state examination in May, 1900, and
entered the service of Hofrat Ganser (discoverer of the syndrome bearing his
name) in the Dresden Hospital for Mental Diseases, then the Municipal
Hospital in Zwickau, where he wrote his Doctoral Dissertation (1904) on
"Carcinosarcoma." Later he worked in the medical polyclinic in Heidelberg
and went then as assistant to Geheimrat Martius at the medical clinic in
Rostock. There he gained the rank of "Privat Dozent" with his work ent-
titled "Researches on the metabolism of iron in pernicious anemia with
remarks about the metabolism of iron in general." (Z. klin. Med., 1913,
79: 49–103), and was, in 1918, appointed “extraordinary” professor. Shortly before the end of the war, in which he participated as a consulting internist, he was chosen chief physician to the medical section of the city hospital of Harburg, near Hamburg. Two days before the Armistice he died in the field, being thrown from a shying horse and run over by a heavy munitions truck. He was not married.

It is true that his scientific production was small in relation to his natural gifts, but we must remember that his scientific work was greatly hindered by war service. Also, Prof. Curschmann says that he never had the itch to write. His chief, Martius, was an outspokenly theoretical worker and left to Queckenstedt in large measure the time-consuming labor of the clinical service. Besides those noted already, he wrote another work on “Changes in the spinal fluid in diseases of the peripheral nerves, especially polyneuritis and sciatica” (Dtsch. Z. Nervenheilk., 1917, 57: 316–329) and showed for the first time the increased protein observed in such cases. His friends say that he wrote other less well known articles, among these during the war one on “Slight typhoid involvements, especially typhoid periostitis in vaccinated patients.” These articles, due to present unfavorable conditions in Germany, we have been unable to locate.

Since interest in investigating the peculiarities of the spinal fluid was in the air, as it were, at the time, it was probably no accident that it was Queckenstedt who discovered his phenomenon since, as we already know, he had a special innate gift for physical and mathematical problems. His test soon became known everywhere as was to be expected. Nowadays it belongs to the armamentarium which a young neurologist has to master in the very first days of his training. Probably no lumbar puncture is done nowadays in a neurological or neurosurgical hospital or clinic without Queekenstedt’s test being automatically made. In the meantime, the method has been improved upon. One no longer has to compress the cervical veins brutally by hand but can use an inflatable rubber cuff (Viets) to regulate the compression more delicately. Also one has begun to measure the pressure of the fluid both in the cisterna magna and the spinal sac. With the patient lying down, both suboccipital and lumbar regions are punctured (Ayer, Tönnis) and manometers attached. At intervals of five seconds the pressure of the fluid after compression (Stookey) is read and registered on a curve. If differences in the speed with which the liquor rises, or in the pressure of the fluid, are found, it is possible in good time to demonstrate visually the earliest manifestations of a beginning obstruction to the vertebral canal between the occipital foramen and the lumbar spine.

Queekenstedt died at the age of 42. He was a casualty of the first World War. His gifts, character and training were such as to have led us to expect many other important contributions if he had lived longer.