The pyramidal syndrome and the pyramidal tract

A brief historical note

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ABSTRACT
The discovery of the pyramidal syndrome and tract is briefly reviewed with emphasis on a few key historical aspects. The pursuit of the relationship between the lateralized deficits resulting from contralateral head trauma begins in the fourth century BC with the Hippocratic School and continues until the present day.

Key words: history of neurology, pyramidal tract, pyramidal syndrome, pyramidal decussation.

A síndrome piramidal e o feixe piramidal: breve nota histórica

RESUMO
Os autores fazem uma breve nota histórica da síndrome piramidal e do feixe piramidal no homem. Os achados de deficiências motoras decorrentes de traumatismo craniano começam a partir do século IV AC com o pai da medicina Hipócrates (460-377) e vão até os dias atuais.

Palavras-Chave: história da neurologia, feixe piramidal, síndrome piramidal, decussação das pirâmides.

One side of the brain controls the opposite side of the body
References to motor paralysis and seizures resulting from a contralateral head injury consistently first appeared in the Western medical record in the fourth century before the Christian Era (BCE) in the writings of Hippocrates (460-377 BCE) and his followers.² Aretaeus, a Greek physician born in Cappadocia who practiced in Rome and Alexandria in the second century BCE, went a step further and distinguished paralysis due to a head injury from paralysis due to spinal injuries, an observation that led him to postulate that some kind of crossing must take place above the craniovertebral junction. However, where exactly the crossing occurred remained a mystery for centuries.³

One critical step towards the unraveling of the exact site at which the crossing took place was given when the locus of damage was consistently transferred from “the head” to the brain, which occurred in the eighteenth century only.⁴ Valsalva and Morgagni, around 1707, were the first to apply the concept of the crossed association between brain injury (not just head trauma!) and contralateral neurologic symptoms (weakness, seizures, and loss of vision). In 1709, Domenico Mistichelli (1675-1715), professor of medicine at the University of Pisa, first mentioned and illustrated the pyramidal decussation. In chapter VIII of his “Trattato Dell’Apoplessia”, Mistichelli explained how an injury of one side of the head resulted in paralysis of the opposite side of body. He speculated that the phenomenon of crossed hemiplegia was explained by the crossing of the “nerves” in the bulbar pyramids. Soon thereafter, François Pourfour du Petit (1664-1741), a French military surgeon serving in Flanders, observed sol-
diers with paralysis of the side of the body contralateral to that of an injury to the head. Petit published his observa-
tions as a small pamphlet entitled "Lettres d’un Mé-
decin", one of the rarest texts of medicine. William Osler
(1849-1919) read the "Lettres" of Petit and commented on
it with Thomas, professor of neurology at Johns
Hopkins, in the beginning of the twentieth century.2

It may seem odd that the pyramidal crossing and its
clinico-anatomical significance were still debated by the
second half of the nineteenth century by such eminent
scholars as Franz Joseph Gall (1758-1828), John Cheyne
(1777-1836) and Vicq d’Azyr (1748-1794). Charles Bell
(1774-1842), for example, made no reference to the py-
ramidal crossing in his "Idea of a New Anatomy of the
Brain" published in 1811. However, in 1853, Moritz Hein-
rich Romberg (1795-1873), in a lecture on cerebral lo-
calizations, stated, "The most established fact and rarely
threatened by a single exception, is the law of crossing
conduction". Speaking to the Royal Society of London in
1834, Bell downplayed the work of those who preceded
him and demanded priority for the discovery.

Despite the thoroughly documented evidence, Craigie
denied the decussation of the pyramids in the 1851 edition
of his "Elements of General and Pathological Anatomy",-
stating that the only unambiguously demonstrated
crossing hitherto was the decussation of the restiform pro-
cesses. The definitive word about decussation of the py-
ramids as an established anatomical fact and substrate of
the Law of Crossed Conduction had to wait the develop-
ment of techniques for tracing the secondary degenera-
tions in the central nervous system, which reached its full
development in the second half of the nineteenth century.

The controversy comes to an end... or does it?

In 1850, Waller described the non-inflammatory de-
generation of the distal segment ("anterograde degenera-
tion") to the section of a peripheral nerve fiber separated
from its trophic center (i.e., the neuronal body). The my-
elin sheath also degenerated into an interrupted chain of
lipid stained fragments by the technique of Marchi. Re-
alizing the importance of this phenomenon, Waller ex-
 tended its applications to the tracing of the myelinated
tracts in the central nervous system of patients who had
suffered brain damage and survived long enough for the
degeneration to take place.

Türck and Charcot were the first to chart the de-
scending course of the pyramidal tracts with the new
techniques. Ludwig Türck (1810-1868), an Austrian
laryngologist, described the degeneration of the py-
ramidal tract on a patient with contralateral hemiplegia
due to a deep cerebral hemorrhage. A few years later,
Jean-Martin Charcot (1825-1893) published the case of a
"hysterical contracture of the four members" with de-
generation of the lateral funiculus of the spinal cord.8
Maybe this represents one of the first clinico-anatomical
cases of amyotrophic lateral sclerosis.9 The observation
of secondary degeneration in cases of hemiplegia formal-
ized the definition of pyramidal tract as "the ensemble of
nerve fibers that cross at the bulbar pyramids".

The exponential growth of data on the internal struc-
ture of the central nervous system in the short period
that spans the last decades of the nineteenth century
is shown by the work of Dejerine, which definitely set-
tled any possible remaining quibble on the association of
hemiplegia with an injury of the pyramidal tract.

The beginning of the twentieth century was marked
by an extravagant documentation of diagnostic signs of
hemiplegia, as well as of the cortical origin and spinal
destination of the pyramidal tract fibers. However, the
development of experimental neurophysiology and its
influence on clinical interpretations allied with the lack
of diagnostic tools allowing the in vivo rendering of the
human central nervous system have led to a reductionist
view in which distances between humans and other pri-
mates, and even among humans and quadrupeds, were
hardly taken into account. The epitome of this period
was the growing influence of the "extrapyramidal system"
on neurological thought, an intricate concept which will
be dealt with in a forthcoming article.

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