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SPECIAL ARTICLE

A MIDLINE SAGITTAL BRAIN VIEW DEPICTED IN DA VINCI'S "SAINT JEROME IN THE WILDERNESS"

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It is estimated that around the year 1480 Leonardo da Vinci painted *Saint Jerome in the Wilderness,* representing the saint during his years of retreat in the Syrian dessert where he lived the life of a hermit. One may interpret Leonardo's *Saint Jerome in the Wilderness* as St. Jerome practicing self-chastisement with a stone in his right hand, seemingly punching his chest repeatedly. The stone, the lion and a cardinal's hat are conventionally linked to the saint. A skull was also almost always present with the image of the saint symbolically representing penance. With careful analysis of the painting one can identify the skull which is hidden in an arc represented as a lion's tail. The image is of a hemicranium (midline sagittal view) showing the intracranial dura, including the falx and tentorium, and venous system with the sinuses and major deep veins. This may have been the first time when the intracranial sinuses and the major deep venous vessels were illustrated.

Key-word: Radiology and radiologists, history.

It is estimated that around the year 1480 (1) Leonardo da Vinci (1452-1519), painted *Saint Jerome in the Wilderness (*tempera and oil on 103x75 cm walnut panel, *Vatican Museums, Rome)*, representing the saint during his 4 years of retreat in the Syrian desert where he lived the life of a hermit. Many other painters have depicted Saint Jerome in their works including Bartolomeo Cavarozzi (1590-1625), Michelangelo Merisi da Caravaggio, 1571-1610), Francisco de Zurbarán (1598-1664), Palma Giovane (1548-1628), Louis Cretey (1635-1702), and Pieter Coecke van Aelst (1502-1556) among others (2).

One may interpret Leonardo's *Saint Jerome in the Wilderness* as St. Jerome practicing self-chastisement with a stone in his right hand punching his chest repeatedly. A skull, representing penance, almost always accompanied the image of the saint. In Renaissance art the skull also symbolized the transitory nature of life on earth or represented a hermit and his contemplation of death (2, 3). The skull has not been described as portrayed in this painting by da Vinci.

After a careful analysis of painting we were able to identify a skull which is hidden in an arc represented as a lion's tail (Fig. 1). The image of the skull is actually a mid sagittal view that shows midline structures such as the falx and the tentorium and the venous system with the sinuses and the major deep veins (Figs. 1 and 2) (4). The lower part of the skull was cut laterally in such a way as to show the bone just below the transverse and sigmoid sinuses (Fig. 2). In this painting one can see the anatomical details of the different veins and sinuses, namely straight sinus, great vein of Galen, deep internal cerebral veins, superior vermian vein, superior and inferior sagittal sinuses, transverse sinus, sigmoid sinus, and the basal vein of Rosenthal (Fig. 2) (5-7).

Above the skull an image of a head without the calvarium is seen (Fig. 1). A detail that may be interpreted as a folded scalp is seen in the lower part of the head as in a dissection of a human body designed to explore intracranial contents (Fig. 1).

Leonardo da Vinci dissected a series of human cadavers in an attempt to understand superior cognitive functions (i.e. *sensus imprensiva, sensus communis, memoria*) through the study of intracranial contents (8, 9). His illustrations of the human skull contain an outstanding amount of anatomical details (8-13). He is credited with the first accurate depictions of the frontal sinus, the anterior and middle meningeal arteries and the anterior, middle, and posterior cranial fossae and in addition, he is considered to be the first scientific illustrator in the contemporary sense (10, 13).

Charles O'Malley and John Saunders in their introductory text to the book *Leonardo on the Human Body* state that da Vinci's earliest anatomical drawings, which have survived to the present day, are thought to date from c. 1487 (8). Rather than experience with real dissections of the human body, they hypothesized that at that time da Vinci was influenced by the works of Avicenna (A.D. 980-1037), Claudius Galenus (Galen of Pergamon, A.D. 129-c. 200/c. 216), and Mondino De'Luzzi (c. A.D. 1275-1326) and animal dissections in addition to surface inspections of living human beings (8). It is believed that da Vinci had intended to write a treatise on anatomy in the late 1480s, since in plate 5 (dated 1489) he wrote the sentence "the book on the human figure" (14).

It is known that da Vinci's dissected human corpses at the Santa Maria Nuova Hospital in Florence and later in Milan at the Maggiore Hospital and at the Santo Spirito Hospital in Rome. He also collaborated with the anatomist Marcantonio della Torre (1478-1511) in the years 1510-1511 and it seems that he had access to a convict's head in the year 1489 (15). Before 1489, little is known as to whether da Vinci actually had the opportunity to dissect human cadavers. It is conceivable that he was able to draw the skull without any direct

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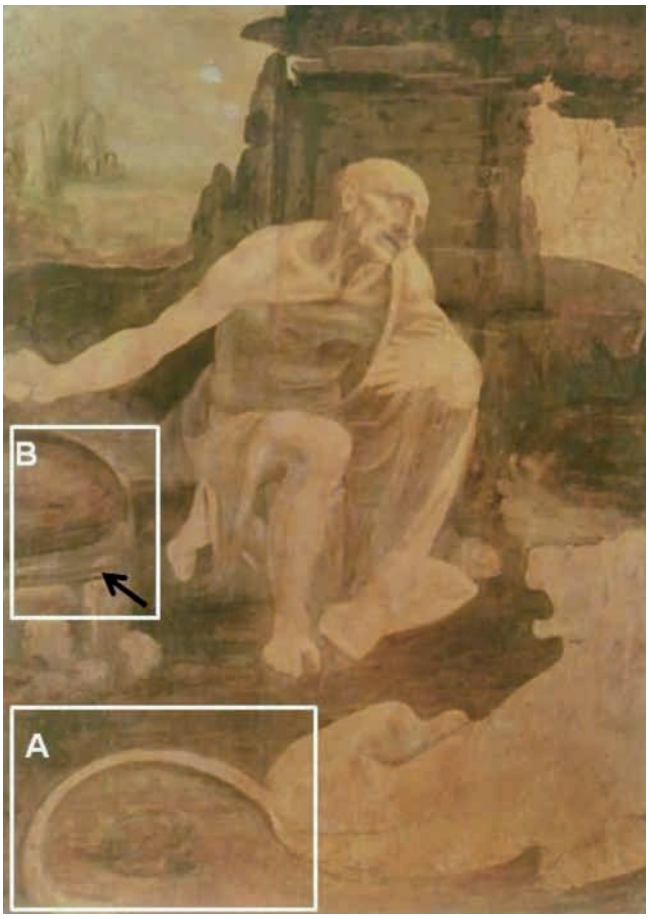

Fig. 1. — Leonardo da Vinci's "Saint Jerome in the Wilderness". A. The image is of a hemicranium (right side opening) showing the structure of the intracranial dura-mater, including the falx and the tentorium, and the venous system with the sinuses and major deep veins. B. Above the depicted skull, the image of a head without the calvarium is seen. The detail interpreted as a folded scalp (black arrow) can be seen in the lower part of the head, as in the dissection of a human body to explore the intracranial content.

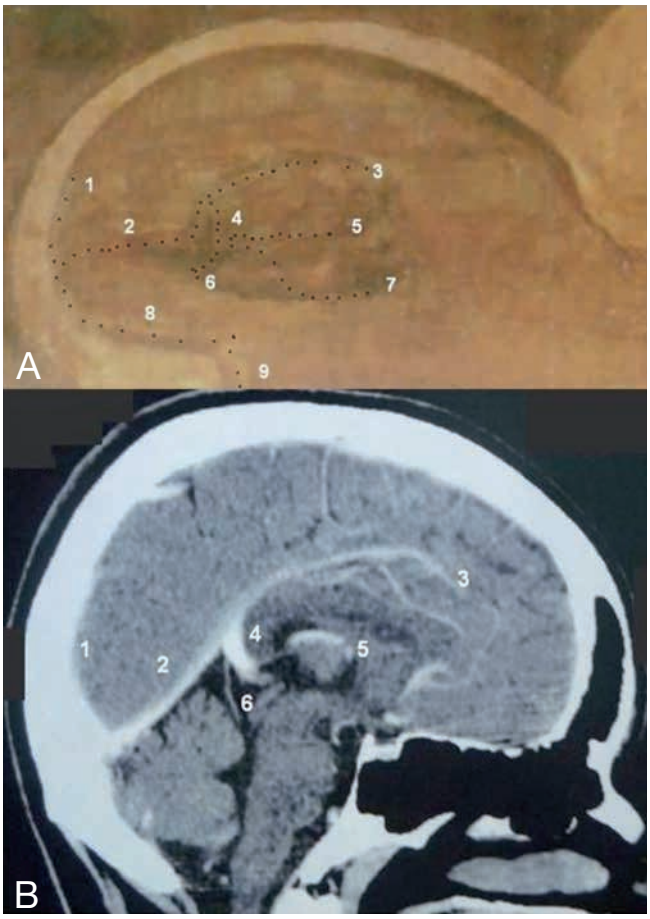

Fig. 2. — The image is of a hemicranium (right side view) showing the structure of the intracranial dura-mater, including the falx and the tentorium, and the venous system with the sinuses and the major deep veins. A. Part of da Vinci's "Saint Jerome in the Wilderness" was zoomed in to better show the anatomical details, illustrating the different veins and sinuses, namely (1) superior longitudinal sinus, (2) straight sinus, (3) inferior longitudinal sinus, (4) great vein of Galen, (5) deep internal cerebral vein, (6) vermian superior vein, (7) basal vein of Rosenthal, (8) transverse sinus, and (9) sigmoid sinus. B. A normal midline sagittal CT view of adult shows some of the same anatomic details illustrated by da Vinci in his painting.

observation of human dissections because skulls as well as the rest of the skeleton were easy to find in Europe in the second half of the XV century. But, in order to draw the intracranial contents with the deep venous system it must have been necessary to see a newly-dissected body in the first few hours or days after death and avoid putrefaction of the corpse. Moreover, the amount of anatomical detail observed in the painting here assessed representing the complex structure of the various vascular components must be a result of a thorough examination and meticulous dissections. This makes us wonder whether da Vinci had a chance to dissect a brain and its surrounding bony structures prior to conceiving the idea of painting *Saint Jerome in the Wilderness*.

Some experts consider *Saint Jerome in the Wilderness* to be one of da Vinci's unfinished works. Thanks to the wealth of detail found in *Saint Jerome in the Wilderness* we question whether he intended to be this way. Among his paintings Saint Jerome in the Wilderness (together with Adoration of the Magi) is one of the few credited as being unquestionably his own work.

Other famous painters, notably Michelangelo, also depicted neuroanatomical structures in their paintings. In the Sistine Chapel, in the panel depicting *The Separation of Light and Darkness*, he painted a brainstem hidden in God's throat (16). Additionally, the panel titled *The Creation of Adam* can be interpreted as grossly also showing a simple diagram of a midline sagittal view of the skull and brain (17). Since both Michelangelo and da Vinci lived at the same time, anatomic dissections and the brain could have been a shared interest.

In conclusion, da Vinci was a distinguished anatomist and a pioneer in the depiction of the intracranial venous sinuses and deep veins. The painting here discussed may be the first time that the intracranial sinuses and major deep venous vessels were illustrated indicating that this finding is of importance in the history of neurovascular anatomy and Renaissance art. This painting may be the

first midline sagittal image of the brain ever painted and it projection is akin to the commonly used views in magnetic resonance imaging or sagittal reformations of CT data.

References

1. Feinberg L.J.: The Young Leonardo. Art and Life in Fifteenth-Century in Forence. Cambridge University Press (2011).
2. De Bles M.A.: How to Distinguish The Saint In Art By Their Costumes, Symbols and Attributes. Art Culture Publications/Wynkoop Hallenbeck Crawford Co, New York, (1925).
3. Ferguson G.: Signs and Symbols in Christian Art: With Illustrations from Paintings from the Renaissance, Oxford University Press (1966).
4. http://education.yahoo.com/reference/gray/subjects/subject/193 (November 29, 2012)
5. Ono M., Rhoton A.L. Jr., Peace D. & Rodriguez R.J.: Microsurgical anatomy of the deep venous system of the brain. *Neurosurgery*, 1984, 15: 621-657.
6. Curé J.K., Van Tassel P. & Smith M.T.: Normal and variant anatomy of the dural venous sinuses. *Semin Ultrasound CT MR*, 1994, 15: 499-519.
7. Schreiber S.J., Stolz E. & Valdueza J.M.: Transcranial ultrasonography of cerebral veins and sinuses. *Eur J Ultrasound*, 2002, 16: 59-72.
8. O'Malley C.D. & Saunders J.B.C.M.: Leonardo on The Human Body. Dover Publications, New York (1983).
9. Del Maestro R.F.: Leonardo da Vinci: the search for the soul. *J Neurosurg*, 1998, 89: 874-887.
10. Andrassy R.J. & Hagood C.O. Jr.: Leonardo da Vinci: anatomist and medical illustrator. *South Med J*, 1976, 69: 787-788.
11. Cavalcanti D.D., Feindel W., Goodrich J.T., Dagi T.F., Prestigiacomo C.J. & Preul M.C.: Anatomy, technology, art, and culture: toward a realistic perspective of the brain. *Neurosurg Focus*, 2009, 27: E2.
12. Tascioglu A.O. & Tascioglu A.B.: Ventricular anatomy: illustrations and concepts from antiquity to Renaissance. *Neuroanatomy*, 2005, 4: 57-63.
13. Ione A.: Chapter 19: Visual images and neurological illustration. *Handb Clin Neurol*, 2010, 95: 271-287.
14. Gerrits P.O., Veening J.G.: Leonardo da Vinci's "A Skull Sectioned": Skull and dental formula revisited. *Clin Anat.* 2012, 19. doi: 10.1002/ca.22060. [Epub ahead of print]
15. Turner A.R.: Inventing Leonardo: The Anatomy of a Legend. University of California Press, (1994).
16. Suk I., Tamargo R.J.: Concealed neuroanatomy in Michelangelo's Separation of Light from Darkness in the Sistine Chapel. *Neurosurgery*, 2010, 66: 851-861.
17. Meshberger F.L.: An interpretation of Michelangelo's Creation of Adam based on neuroanatomy. *JAMA*, 1990, 264: 1837-1841.