What did Leonardo da Vinci know about Atherosclerosis 125 years before William Harvey?

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Leonardo da Vinci
2452-1519

Genius of the Renaissance

- World’s most famous painting – Mona Lisa
- Equally gifted in – Architecture, Engineering, Anatomy*
- Described atherosclerosis in 1504 – Wm Harvey published theory of blood circulation in 1628

*6000 pages in notebooks on wide variety of subjects

Leonardo Describes Atherosclerosis 1504

- “The old man” – 100 years old, “sweet, painless death”
  - Performs autopsy
  - Death due to “failure of the artery that feeds the heart and lower members”
  - the “vessels elongate and become tortuous and their coat thickens so much as to occlude and prevent the movement of blood”
  - Vessel wall thickens due to “excessive nourishment of the blood”

Leonardo on Hydrodynamics

- Flow of rivers; fluids in pipes and glass tubes with markers
- Applied physical laws observed in rivers to blood vessels in man
  - Arteries, with the passage of time, grow in length and become tortuous for similar hydrodynamic reasons
- The heart, coronary arteries, valvular function
  - Eddy currents in areas of Valsalva cause aortic valve leaflets to close

500 years later
Hemodynamics and Atherosclerosis

flow modeling, correlation to human atherosclerosis

Carotid plaques localize in regions of low shear stress and increased particle residence time

Disclosure

Nothing to disclose
**Da Vinci’s Paintings**

- The Last Supper
- St. John the Baptist
- Lady with Ermine
- Virgin of the Rocks

**Did da Vinci leave secret codes?**

- A murder in the Louvre and clues in Da Vinci paintings lead to the discovery of the Holy Grail, protected by a secret society for 2000 years.

**Mona Lisa**


**Da Vinci loved riddles**

- He used symbols in his works to give out messages.

  "Da Vinci had a special bond with the Mona Lisa and we know that in the last years of his life he took the painting with him everywhere"*.

  - Painted 1503-1506
  - Died 1519

  *2010, Silvano Vinceti, National Committee on Cultural Heritage of Italy

**What is the secret?**

- There are letters and numbers in the pupils of the eyes: "to the naked eye the symbols are not visible but with a magnifying glass they can be clearly seen".

  *2010, Silvano Vinceti, National Committee on Cultural Heritage of Italy

**Hidden Clues**

- xanthelasma
- lipoma
Xanthelasma and Familial Hypercholesterolemia

- First evidence in Mona Lisa 1506
  - Xanthelasma, left eye and lipoma on dorsum of hand
  - Died at age 37, cause of death unknown

- Published case reports
  - Addison and Gall 1852; Fagge 1873 – xanthelomatosis with CV symptoms
  - Lahzen and Knaus 1889 – 11 yo girl with xanthomas; xanthomatous deposits in aorta
  - Harbitz 1927 – xanthomatosis and sudden death
  - Muller 1937 – xanthoma tuberosum with angina pectoris

- Landmark paper 1937, Carl Muller
  - 17 families, 76 members; 90% had sx of heart disease;
  - xanthomas, elevated cholesterol levels and sudden death in 50%

- Brown and Goldstein 1973
  - Demonstrated LDL receptors that regulate cellular uptake; defective gene in familial hypercholesterolemia
  - Nobel Prize in physiology and medicine 1985

The Real Code of Da Vinci

Code for familial hypercholesterolemia and Key to atherosclerosis

Hidden in plain sight for 500 years in Leonardo's painting of the Mona Lisa

Scientific proof (LDL receptor - Brown and Goldstein, 1973) and Hemodynamic evidence (plaque localisation, artery remodeling – Zarins, Glasgow 1983) published well before the code was broken in 2004*

*Medical archeology, Dequeker, IMAJ 2004; 6: 505

"nothing strengthens authority so much as silence"
Leonardo da Vinci