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Brain protection is used since the early 50s by cardiovascular surgeons**Guy Hugues Fontaine^{1, 2}**¹Pitié-Salpêtrière Hospital, France²Université Pierre et Marie Curie, France

PFC Cooling: This property was used by a neurologist from Cornell University in New York who had the original idea to cool the brain by evaporation of PFC in nasopharynx and fossa nasalis. PFC was evaporated in a flow of oxygen. A multicenter international prospective study has been performed but did not reach statistical significance. This was due to a too small number of cases and that cooling was initiated 23 after the drop. Author's alternative was that the same result can be obtained by abrupt decompression of highly compressed gas. Choice of cooling gas: Joule-Thomson coefficient suggested that CO₂ was the gas producing the strongest cooling during its adiabatic expansion. Water cooling: The first experiments were made in vitro in water. This demonstrated the formation of ice ball at the injector exit related to the low temperature at the site of CO₂ expansion. Agar-agar cooling: A mock-up of the human brain was performed with agar-agar in which a blind tube was simulating the mouth and oropharynx. Infra-red imaging demonstrated the cooling by regular convection toward the brain and forced convection up to the exit. Therefore, cooling was not localized at the exit of the injector. Severed pig head cooling: Experiments demonstrated that the bones were not distorted by the cooling process as shown by infra-red imaging. It was concluded that mouth can be as good as fossa nasalis after a delay of few minutes. This fundamental experiment suggested that cooling through the mouth can be also used in stroke on the field as a public access device. Rabbit cooling: It was confirmed on this small animal model that CO₂ was better than O₂. A mixture of both gases can be considered CO₂ replacing N₂ with the same percentage of O₂ (20%). Live pig cooling: The results demonstrated that it was possible to obtain the same cooling as PFC evaporation at WICCM (Fontaine EHRA Milano 2015). It was concluded that a pilot study in human was the next step forward.

guy.fontaine2@numericable.fr

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