The most accessible and best developed method available today for cerebral blood flow (CBF) measurement by positron emission tomography is the continuous inhalation technique using $\text{CO}_2$ labeled with oxygen-15(1). Among the theoretical limitations of the technique, the most important is the assumption that oxygen-15 labeled water (the actual tracer of blood flow which is produced in vivo after inhalation of labeled $\text{CO}_2$) is freely diffusible across the blood-brain barrier. This assumption has been demonstrated to be inaccurate in several studies using both animals(2) and man(3).

The use of $\text{N}_2\text{O}$, an inert and freely diffusible gas at any flow rate, would allow an improved measurement of CBF even with its other limitations which arise from its short half-life.

It was therefore of interest to investigate the continuous production of nitrous oxide labeled with oxygen-15.

This has been accomplished by oxidation of ammonia using a stream of $^{15}$O-labeled oxygen (4).

$$\text{4 NH}_3 + 4 \text{O}_2 \rightarrow 2 \text{N}_2\text{O} + 6 \text{H}_2\text{O}$$

The oxygen-15 was produced by irradiation of an $\text{N}_2 + 2\% \text{O}_2$ mixture with 8 MeV deuterons(5). Ammonia was added to the target gases as they emerged from the target and the mixture was passed through a furnace containing a platinum on alumina catalyst at 300°C.

The oxidation conditions: gas flow over the catalyst, quantities of ammonia and oxygen, dimensions of the furnace, and quantity of the platinum catalyst were studied as well as the stability of the catalyst. Analysis of the reaction products was performed using gas chromatography; 50 - 80% of the activity leaving the catalyst was found to be $\text{N}_2\text{O}$ according to the conditions used.

The purification of the gas to remove unreacted oxygen gas and nitrogen oxides that might have formed is under study.

Using a flow rate at the target of 450 ml/min, a 25 $\mu$A irradiation yielded 40 $\mu$Ci/ml of $\text{N}_2\text{O}$ with 3% $\text{N}_2\text{O}$ carrier at the outlet of the system located 20 meters from the target.
(5) Clark J.C., Buckingham P.D., Short-lived radioactive gases for clinical use Butterworth, 1975, 135-140.

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