The observation that a wide range of physiological and biochemical changes occur during exposure to microgravity suggested that microgravity-induced changes might alter the pharmacodynamics of drugs administered during weightless flight. These changes might affect drug absorption as had been suggested by Dr. Leach who was instrumental in starting the NASA pharmacodynamics group. It might also cause metabolism changes as a result of altered blood flow to the kidneys and liver. For NASA flight surgeons, this possibility is of considerable clinical significance since many crewmembers experience space sickness during the first 48-72 h of orbital flight and because returning crewmembers regularly show decreased tolerance to upright posture in gravity. Both sets of symptoms should be preventable or should at least be ameliorated with targeted pharmacological interventions. Most crews have no medically trained member on board so parenterally administered medications are both inconvenient and are not preferred by a symptomatic individual about to be injected by an inexperienced fellow crewman. There are other problems with administering drug therapies in orbit since the most common and important crew afflictions are regularly associated with nausea and, in extreme cases, regurgitation at irregular and unpredictable intervals. Loss of stomach contents likely would include any recently ingested medication. Some NASA personnel believe that this space sickness is associated with cessation of small bowel motor activity so that ingested medications might remain in the stomach for considerable periods delaying the time to reach therapeutic levels and possibly making the medication ineffective.

Classic pharmacology regularly uses invasive methods, such as multiple venipunctures, to follow the absorption and disposition of experimental drugs. In operational missions it is not practical to obtain multiple blood specimens from crewmembers busy with other duties. There are other problems also. The crewmembers generally have only the rudimentary medical training given them by the flight surgeons as a minor part of preflight preparations. These lectures contain just enough information to help the crew in emergencies to respond correctly to illness. There are plans to try to use and study other drugs which may be excreted in the saliva and which show nearly constant salivary/plasma ratios through wide ranges of concentrations. Generally, any drug which distributes into total body water should appear in the saliva. The space sickness medication most commonly taken by susceptible individuals is a combination of scopolamine and dextroamphetamine. This combination medication was studied one time in one crewman while in orbit but, unfortunately, the samples obtained were unsatisfactorily small. Perhaps this resulted because these drugs decrease the rate of salivary production. There are plans to repeat this study in future missions. Further drug testing is planned to obtain statistically valid numbers.

Obtaining salivary samples seems to be popular with crewmembers who have participated so far since they, like almost anyone, would prefer not to experience the pain and inconvenience of multiple blood specimens. NASA management likes this program since it is a low budget, low power, and low weight way of obtaining operationally significant data. Salivary specimens to obtain endocrine measurements were suggested and studied by Dr. Craig Fischer, who directed the Clinical Laboratories at the Johnson Space Center during the Gemini-Apollo era. In those early days, a cap was attached over the parotid duct to quantitatively collect the needed, relatively uncontaminated, saliva samples. While studies were undertaken, the salivary collection cups were never used in flight. Until the present series of inflight studies, no NASA scientist had taken advantage of salivary samples to eliminate inflight phlebotomies.

These bright investigators have demonstrated a way to obtain valid drug absorption data under the operational constraints of a routine Shuttle mission. Perhaps other members of this Space Medicine Branch might find ways to use salivary specimens for this or other purposes. Salivary collections may be a convenient way to advance the field of aerospace physiology when the investigator must use subjects involved in operational activities. We look forward to the continuation of this innovative approach to space medicine research.
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