

INTERIM REPORT ON GASTRIC MOTILITY
IN SPACE MOTION SICKNESS

BACKGROUND: Gastro intestinal signs and symptoms are considered Hallmarks of Motion Sickness with vomiting being taken as the end stage. A number of studies of the gastro intestinal tract have been made during acute motion sickness 1,2 and while it was generally found that ^{this} ~~acute motion~~ sickness is accompanied by a reduction in gastric motility little recent work had been done in this area and none at all in space motion sickness. In motion sickness, both natural and induced, it has been the general impression from casual observation and certainly that of the author, that nausea precedes or accompanies vomiting which is likely to be repeated until the stimulus is removed, or in the case of sea sickness or other prolonged stimulus, recovery occurs. At least 2 investigators report that vomiting without preceding nausea sometimes occurs 3. I have not seen this in 1 g motion sickness. Reliable reports of SMS contrasted sharply with its hallmarks of 1g motion sickness, pallor, cold sweating, nausea and vomiting. Flushing was

1. Reason, J. T. and J. O. Brand, Motion Sickness, pp 57-59, Academic Press, New York, 1975.
2. Money, K. D., Motion Sickness, Physiological Reviews, 50,1-39, 1970.
3. Ibid 1, p. 40

reported as often as pallor, sweating was denied and sudden vomiting usually without preceding nausea was the rule although nausea with or without vomiting was the only symptoms^b in some subjects. In contrast to the common experience of lg motion sickness* vomiting in SMS is episodic, brief and frequently without nausea or other premonition and occurs infrequently in flight.

As part of an extensive study of SMS etiology on STS-7 the ^{on board} physician (Thagard) did physical exams and found virtually total absence of bowel sounds during SMS in those affected in contrast to after recovery or in those unaffected. His view ~~was~~ that a profound temporary ileus was present. ~~This~~ ^a was consistent with the signs and symptoms which included vomiting of undigested food or in the absence of intake, clear gastric ^c ~~intestinal~~ liquids, ~~6~~ + saliva.

^{temporary} For the cause of the G.I. sx. in SMS
With ~~an~~ ^a ileus ^{**} as a working hypothesis efforts to 1) document the ileus and 2) to reverse, it were undertaken prior to STS-8. A variety of instrumentation including those commonly used in motility studies was considered however circumstances allowed only direct and recorded

(MS)

* Unless otherwise noted motion sickness designates lg motion sickness ~~and~~ SMS space motion sickness.

** The cause ~~of~~ & mediation of this ileus is not addressed here but undoubtedly arises from the intravestibular & possibly other sensory conflicts of weightlessness. How it is transmitted, by the autonomic nervous system or humoral agents or both is of great ~~prae~~ theoretical and practical import.

auscultation and a N.G. catheter mounted pressure recorder. These were flown and as a result, ^{follow on} a program for recording and semi-quantitatively measuring bowel sounds in MS and SMS was undertaken and results to date ^{will be} described. In addition a gastro intestinal motility stimulant was tried on STS-8 and as a result a program for its inflight use ^{was attempted,} ~~initiated~~.

The defense of bowel sounds as an indication of gastro intestinal motility will be discussed, ~~but~~ ^{its} limitations are well recognized however, it remains the primary indicator in clinical practice including life and death surgical decisions. Contacts were made with a number of people ^{recognized for working in} ~~in this~~ ^{motility} area and visits ^{to three} ~~with three~~ recognized facilities investigators were made. While work ^{also} has been done on the use of the Electro Gastro Gram including development and test of instrumentation, bowel sounds remain the method of choice to date.

Availability of a medical student made it possible to do a limited number of acute MS studies and finally some ^{additional} inflight records were obtained.

METHODOLOGY AND PROTOCOL

STS-8 - Bowel sounds - Andries electronic stethoscopes were selected for ^{1/4} both auscultation and recording. The stethoscope is a self contained ²/₆ X ^{1 1/2}/₆ X ²/₆ ⁱⁿ unit with head phones and jacks for recording. Two such units were coupled to the two channels of a miniature professional tape deck (Sony TCD5M) and the stethoscopes bound to the R and L upper quadrants by a ^{right left} 6" elastic bandage. Figure 1 is a photo of its use in flight. Typical

1. Stern, R.M. + C.M. Davis
Gastric Motility, A Selectively Annotated Bibliography
Hutchinson Ross Publ. Co., Stroudsburg, PA 1982
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response of the microphone and recorder are shown in Figs. ____ and ____.
 When used with Sony ^{MDR 50 head,} phones, auditory quality was excellent on replay. Pre-flight all subjects were both listened to and recorded and inflight all subjects were auscultated during and after the period of SMS with bowel sounds recorded on subjects with SMS as described in results.

^{STS-8} Post-flight ^{recording to the hardware} several modifications were made to allow usage by personnel with a C/L and minimal training. This included a fixed gain system, addition of external batteries for longer life, reduction in stethoscope case size, provision of a body interface to prevent "tipping" and loss of transmitted sound, incorporation of the stethoscope apparatus into a single universal velcro secured elastic belt and replacement of the tape deck with a miniature unit. The latter item was a ^{SONY WMD6} 'professional' recording version of the Sony Walkman series which are flown as entertainment items, ~~and~~ it was ^{also} intended as an interchangeable unit but the body politic has not allowed this saving in weight by insisting on separate recorders ^{to date.} This recorder has astonishing performance for such a small unit, ^{characteristics are shown in Fig 1} ~~1 1/8~~ ^{1 1/8} x ^{3 3/4} x ^{7 1/4} and lbs, ^{7oz,} which can record for up to 2 hours/cassette. ^{& custom cassettes} We use selected tapes from Andries for increased reliability and this limits recording to 1 1/2 hours or 45 minutes/side.

^{light & top quadrant} Stethoscopes are placed over the R & L U.Q. and operation consists of turning on recorder and battery switch. *The subject can engage in his usual activities and the recorder automatically turns itself off.*

supply mounted on an elastic velcro coupled belt. Operations consist of turning on the recorder, checking pre-set control and connecting the microphone belt and placing it around the waist. A recording time of 45 minutes/cassette side is available and requested. The crewman is free to perform his usual tasks during the recording.

Gastric catheterization STS-8: A ^{PC 460 6 French C} millar catheter ^{TCB-100} lumen and single pressure transducer was flowⁿ with a Millar ^{high frequency response was greater than 100 Hz and noise & drift negligible but checked.} coupler and recorded by the FM bioinstrumentation recorder and DC amplifier. Electrical calibration was verified with known pressures prior to flight and electric calibration used in flight. The D.C. amplifier and recorder were independently calibrated. ^{High} Preflight and a single inflight (MD6) record were made by the investigator using standard N.G. techniques, recording at measured distances through esophagus and stomach. *On earth recordings were made at various levels in supine sitting and standing positions. Length of catheter was recorded at various lengths and position confirmed by X-ray.*