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PULMOSYS: CLINICAL SYSTEM FOR ESTIMATION OF NEONATAL VENTILATORY MECHANICS

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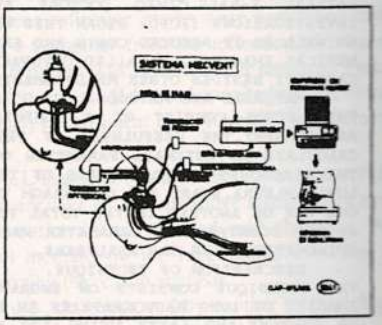
INTRODUCTION: A robust and low cost spirometric equipment was designed. Least Mean Squares fits to a first order model allow estimation of resistance (R) and compliance (C) in basal or controlled physiological conditions with no "cooperation" from the patient. Neither forced expiration nor sedatives are necessary.

MEASUREMENT METHOD: Intrapleural pressure is estimated with an intraesophageal catheter. A pneumotacograph and a pressure transducer are installed on a Leardal transparent plastic mask applied over nose and mouth.

DESCRIPTION: PULMOSYS is a personal computer (PC), a printer, an interface box (MECVENT, up to 7 signals), external transducers and software. Piezoresistive pressure transducers are used for flow and pressure signals, sampled at 40 Hz, 10 bits. Patient insulation is implemented in the transducer electronic circuits.

PULMOSYS displays flow, bucal and esophageal pressure signals and allows selective storing to disk. R, C, inspiratory and expiratory times, volumes and flow estimates are calculated with a quality control check in terms of the standard deviation.



CLINICAL USE: Two prototypes of PULMOSYS are in routine clinical use; two additional units were ordered. Ventilatory mechanics normal patterns were determined with PULMOSYS; the effect of oro- naso-pharyngeal aspiration on neonatal respiratoty adaptation was studied as well as the classification of respiratory anomalies based on the observation of V-P and F-P loops. PULMOSYS has the technical support and the field experience (over 10000 hours of clinical use) necessary to insure successful installations in Hospitals of Latin America and elsewhere.

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STUDY OF THE BREATHING PATTERN IN PATIENTS WITH SPINAL CORD INJURIES (SCI). APPLICATION OF A TRIDIMENSIONAL CINEMATIC COMPUTER SYSTEM.

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SCI patients have breathing dysfunction, characterized by deformation of the chest wall, responsible for a high morbi-mortality. Traditionally the studies of respiratory movements are done using magnetometry or inductive plethysmograph. Such methods do not permit simultaneous records, besides giving difficulties to calibration.

We used 17 reflective marks distributed along a medial axis from the manubrium to the pubic symphysis and two lateral axes. As references 3 other marks were used: one positioned on the bed in order to give an inferior limit of height for the posterior face of the trunk, permitting calculation of imaginary ellipses to each section; the other 2 positioned on the bell of a spirometer. For the examination four cameras were used placed around the bed. The precise position of each mark can be calculated by the computer from the reflection of infra-red rays emitted by the cameras. The marks are captured during breathing in tidal volume (V_t) and vital capacity with the patient in supine posture, during 20 sec (25 Hz). These marks mapping the trunk to describe the movements of thorax and abdomen. The data analysis program was developed in Pascal. The program calculates: linear and sectional area variations and relative movements between marks; paradoxic and asynchronous motion indexes; section/region variation spectral analysis.

Ten control subjects and 9 tetraplegic (C4 to C7) were studied. Below the relative movements between inferior thorax antero-posterior (AP) and spirometer during V_t from a normal subject and tetraplegic patient (C6 level) are shown. The numbers indicate phase angle, asynchrony inspiratory and expiratory indexes and paradoxic motion indexes.

The present methodology has been shown to be very useful in studying the normal pattern motion of trunk, contributing to further characterization of the dyskinetic movements frequently observed in patients with high SCI.