TITLE: **EARLY CLINICAL TRIALS OF AN INTRAVENOUS OXYGENATOR (IVOX) IN PATIENTS WITH THE ADULT RESPIRATORY DISTRESS SYNDROME**

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Introduction: An intracaval device for exchange of CO_2 and O_2 has been developed[1] and is currently undergoing initial clinical evaluation in Phase I of an FDA approved study. The intravenous oxygenator (IVOX) consists of a bundle of approximately one thousand hollow, polypropylene fibers through which O_2 is drawn by vacuum. We present here two cases of ARDS and severe barotrauma that suggest the critical importance of the inferior vena cava (IVC) size and configuration for successful gas exchange across the IVOX.

Methods: Patients are considered for IVOX implantation when they satisfy the following criteria: venous admixture (shunt) ≥ 30% with the inspired O_2 fraction (FIO_2) = 1.0 with positive end expiratory pressure (PEEP) ≥ 5 cm H_2O and pulmonary capillary wedge pressure ≤ 15 mmHg despite diuresis and chest physiotherapy.

Patients were evaluated at the referring hospital and transported to our hospital by helicopter utilizing a Servo Ventilator 900C (Siemens-Elema, Schaumburg, IL) with battery pack for transport. Ultrasound (US) of the internal jugular and common femoral veins was obtained to determine adequacy of these vessels for insertion of the IVOX. The device was inserted via the femoral vessel in both patients because of its larger diameter.

Gas exchange across the IVOX was calculated by mass balance determined by measurement of the partial pressures of the gases entering and leaving the IVOX. Inlet gas includes 95% O_2 and 5% helium for calculation of the Haldane correction. The inlet flow rate was measured using a thermoconductivity gas flow meter.

Results: *Case I:* The patient was a 34 yo female who had been in excellent health until the onset a few days prior to transfer when she developed pneumococcal pneumonia which responded to antibiotics. Subsequently she developed ARDS requiring intubation and progressive elevation of the PEEP and FIO_2. The IVOX was placed and gas exchange was found to be approximately 30 cc/min for both CO_2 and O_2. This did not significantly alter the patient's respiratory or hemodynamic status. The patient's oxygenation continued to fail and the patient subsequently died about fifteen hours after insertion of the device. At autopsy the patient was found to have a IVC diameter of ten millimeters.

Case II: The patient was a 19 yo male previously in excellent health who sustained fractures of the left lower extremity. One day post-injury developed respiratory distress requiring intubation and ARDS. Increasing PEEP and FIO_2 failed to increase arterial oxygenation.

After US of the insertion vessels and the IVC indicated adequate size, the IVOX device was inserted. There seemed to be technical difficulties unfurling the device and again only about 30 cc/min of CO_2 and O_2 were exchanged. The patient was subsequently placed on extracorporeal oxygenation (ECMO). During ECMO, after resolution of subcutaneous emphysema, US showed narrowing to 10 mm of the IVC at the hepatic veins when the central venous pressure (CVP) was 10 mmHg.

Conclusions: Previous animal studies had indicated that approximately 100 cc/min of CO_2 and O_2 could be exchanged with the IVOX. Both our patients received substantially less CO_2 and O_2 exchange. Because of the autopsy findings of our first patient and the US findings during ECMO in the second, we feel that the anatomy and size of the vena cava as well as the CVP may be critical to the performance of IVOX. Our results suggest that if the IVC impinges on the unfurled device, gas exchange will be impaired.

References: 1. Mortensen, JD: An intravenacaval blood gas exchange (IVCBGE) Device. Trans Am Soc Artif Intern Organs 33:570-3.

TITLE: **ASSESSING PROSTACYCLIN (PGI2) EFFICACY IN CONTINUOUS HEMOFILTRATION (CHF) USING A NEW HEMOFILTER PERMEABILITY INDEX.**

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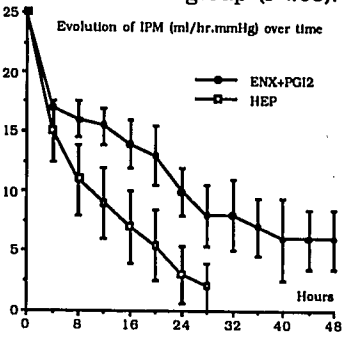
The long duration of extracorporeal circulation used in CHF requires an efficient anticoagulation to limit cumulative thombotic phenomenons. It has been shown that topical PGI2 infused in the arterial port of the hemofilter as inhibitor of platelets aggregation protects platelets *(1)* and avoids the use of large doses of heparin (HEP), even if low doses are already necessary *(2)*.The aim of our current work has been to compare the anticoagulant efficiency of the association of PGI2 with a low molecular weight heparin versus non fractionned HEP used alone.

Method: With institutional approval, 11 patients with acute renal failure (representing 42 hemofiltration periods using AN69S flat hemofilters (Hospal®)), have been randomly included into 2 groups. They received either HEP (9±1 IU/kg.h) or the association of enoxaparin (25±4 µg/kg.h) with PGI2 (4±0.8 ng/kg.min). Hydrostatic (P) and oncotic (Π) pressures were measured over time at the entrance (i), the outlet (o), and in the ultrafiltrate (UF) compartment of the hemofilter. The transmembrane pressure, generating the UF, was calculated as TMP=1/2(Pi+Po)-Puf-1/2(Πi+Πo). UF output was used to define the Hemofilter Permeability Index as HPI = UF/TPM. Systemic and pulmonary hemodynamics, coagulation profiles (including activated clotting time (ACT), activated partial thromboplastin time (APTT), platelets count (PC) bleeding time (BT)), and HPI values were obtained in all patients and compared with Kruskal-Wallis test. P less than .05 was considered significant.

Results: Time to obtain 1/3 of the initial HPI was 13±3.5 hr in HEP group and 29±3.3 hr in PGI2 group (P<.03). ACT and APTT were longer in HEP group while PC decreased. There was no significant change in these variables in PGI2 goup at the onset of CHF. PGI2+ENX did not aggravate hemorrhage and no significant change were observed in hemodynamics.



Discussion: Measuring HPI provides a more accurate comparison of two antithrombotic protocols than the use of function period which is multiple factors. PGI2 associated with LMWH has improved duration of the hemofilter for approximately 55%. In addition, it preserved platelet count and coagulation profile. Despite PGI2 vasodilatator effects, the good cardiovascular tolerance observed could be explained (a: by PGI2 losses in UF, (b: by its short half life and (c: by the low doses employed. However, the administration rate of PGI2 should be very carefully monitored. PGI2 could be a good alternative to HEP in a number of patients, above all in those at high risk of hemorrhage.

References: *(1)* Anesthesiology,**71**,3A,A221,1989 *(2)* Proc EDTA, **21**, 1984.