Anomalies Associated with Single Umbilical Artery at Perinatal Autopsy

We evaluated 214 fetuses sent for autopsy with gestational ages ranging from 12 to 39 weeks. Of these, seventeen fetuses (7.9%) had single umbilical artery. Thirteen of these fetuses were aborted after antenatal detection of severe malformations and 4 died in utero. Genito-urinary system (*n*=6) and central nervous system (*n*=4) were the most common sites of involvement. Presence of single umbilical artery warrants a detailed evaluation of the fetus for other anomalies.

Keywords: *Malformation, Outcome, Survivial.*

Single umbilical artery is one of the most common congenital anomalies with a reported incidence of 0.2-1.2% in live newborns [1]. The incidence is higher (0.3-7%) among twins, fetal deaths, abortuses and autopsies [2,3]. The rate of associated congenital anomalies with single umbilical artery is about 10% as reported by a National Registry [4].

Perinatal autopsy was carried out in 214 cases within a span of 5 years in our center. These fetuses were either aborted due to intrauterine death or after prenatal detection of a malformation. The study was approved by the Institutional ethics committee.

Single umbilical artery was noted in 17 (9 males) fetuses (7.9%). The gestational age of the fetuses ranged from 12 to 39 weeks. All the pregnancies were singletons. Karyotype was done in 6 cases and was normal in four of them. On autopsy, congenital anomalies and/or growth abnormalities were detected in sixteen fetuses. Of the 17 fetuses, 14 had associated major fetal anomalies detected in the antenatal ultrasonogram, while the remaining three had oligohydramnios, intrauterine growth retardation and a choroid plexus cyst, respectively. There was predominant involvement of genito-urinary system in six cases followed by central nervous system in 4 cases. Intrauterine growth retardation, chromosomal abnormalities (trisomy 13 and Turner syndrome), posterior urethral valve with hydroureteronephrosis and neural tube defect were noted in two cases each. There were eight cases with single system involvement while seven fetuses had multisystem involvement. One fetus had intrauterine growth retardation without any associated anomalies. The detailed description of the cases is provided in ***Web Table* I**. Two of these cases have been published earlier [5,6].

The single umbilical artery is known to be associated with poorer perinatal outcome compared to those with two arteries. The incidence of single umbilical artery at perinatal autopsy in our study is similar to the incidence (7.01%) reported by Csecsei, *et al*. [1]. The rate of chromosomal anomalies has been found to be significantly higher (8-11%) among fetuses with single umbilical artery compared to those with two umbilical arteries [7,8]. In our study, chromosomal abnormalities were noted in two fetuses with single umbilical artery and six fetuses without single umbilical artery (11.7% *vs* 2.8%). Similar to previous reports [2,9], our study also shows involvement of urinary system in majority of fetuses.

The etiopathogenesis of absence of one of the umbilical artery is not clear till date. Abuhsmad, *et al*. [10] hypothesized that it could be due to primary agenesis or atrophy of one of the arteries or the persistence of the original allantoic artery in the body stalk of embryo. Also, the poorer perinatal outcome and association of other fetal anomalies in fetuses with single umbilical artery is not clearly understood till date. However, it is important to look for other associated anomalies when single umbilical artery is diagnosed antenatally or postnatally. We conclude that single umbilical artery warrants a detailed evaluation of the fetus for other anomalies.

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Saturation Oxygen Pressure Index for Assessment of Pulmonary Disease in Neonates on Non-invasive Ventilation

This prospective observational study on 36 neonates aimed to estimate the correlation between the new **S**aturation **O**xygen distending **P**ressure **I**ndex (SOPI) and Oxygenation index. SOPI had high correlation (r=0.94) with oxygenation index. SOPI of <2, 2, and 3.7 represented mild, moderate and severe pulmonary disease, respectively with high sensitivity and specificity.

Keywords*: Acute lung disease, Newborn, Noninvasive ventilation, SOP index.*

Neonates with respiratory distress need continuous distending pressure to achieve adequate functional residual capacity. Any change in the severity of pulmonary disease is reflected as a change in need for the distending pressure or fraction of inspired oxygen (FiO_2) or both. A tool incorporating these parameters would potentially help in objectively assessing the severity of the pulmonary disease.

Current assessment of pulmonary disease is with blood gas, chest *X*-ray and Oxygenation index (OI). OI cannot be calculated for babies on Continuous Positive Airway Pressure (CPAP) and Non-invasive Positive Pressure Ventilation (NIPPV), and has resource implications. A non-invasive assessment tool would allow clinicians to use it more frequently. Non-invasive tools such as Oxygen saturation index and Respiratory severity score [1,2] cannot be used in babies on CPAP or non-invasive ventilation. Saturation (SPO_2), Oxygen (FiO_2) and distending Pressure (PEEP) index, or SOP index, attempts to objectively score respiratory disease with parameters available in babies on CPAP or non-invasive ventilation.

This was a single-centre prospective observational study undertaken in a Canadian tertiary care Neonatal intensive care unit (NICU). Our primary objective was to evaluate if the SOP index correlates with Oxygenation index in neonates. Secondary objective was to find the cut-off values of SOP index for mild, moderate and severe pulmonary disease. Both term and preterm neonates on conventional mechanical ventilation were enrolled. Babies with severe congenital anomalies and congenital heart disease and SPO_2 above 98% were excluded from the study. Consent waiver for the study was provided by the McMaster Research Ethics Board.

SOP index was calculated by the formula, PEEP X FiO_2/ SpO_2. PEEP, FiO_2 and SpO_2 on the monitor was recorded prior to arterial blood gas sampling. SPO_2 was recorded when there was a good waveform.

Thirty-six patients were recruited and total of 72 data sets were obtained. The first obtained value for each patient was separately tabulated. Pearson product moment correlation between SOP index and Oxygenation index was calculated. All the data sets combined were analyzed using linear mixed model effect with random intercept for predictive equation. We calculated sensitivity and specificity of SOP index corresponding to oxygenation index of <5, 5 -15 and >15 using ROC curve. We did not stratify the patients according to gestational age.

Pearson product moment correlation (r) of 0.94 (P=0.001) was noted between SOP index and Oxygenation index (***Fig*.1**). The calculated predictive equation for SOP index was *0.28 X* OI + *0.87*. SOP indices corresponding to OI <5 (mild), 5-15 (moderate) and >15 (severe lung disease) are <2, 2 to 3.7 and >3.7, respectively. With 89% sensitivity and 94% specificity. The sensitivity and specificity of SOP index for mild, moderate and severe pulmonary disease was 89.5% and 94.1%, 89.5% and 94.1%, and 100% and 94.6%, respectively.