ScieniQ Publishers

Advance Medical and Clinical Research

Research Article

A Legacy of the Firsts

Boris M Petrikovsky

Obstetrician-Gynecologist and Maternal-Fetal Medicine Specialist, New York, USA

***Corresponding author**
Boris M Petrikovsky. Obstetrician-Gynecologist and Maternal-Fetal Medicine Specialist, New York, USA

Received: 18 June 2026
Accepted: 25 June 2026
Published: 30 July 2026

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Weighted Fetal Biophysical Profile Score (FBP)

The FBP became a gold standard for fetal assessment during pregnancy. It includes five major parameters of fetal well-being: amniotic fluid (AF), NST, fetal breathing, fetal movements, and fetal muscular tone.

According to the traditional scoring systems, an equal score is assigned to different variables, which is questionable from both a theoretical and practical point of view. Each component of the FBP is controlled by a different part of the fetal brain: Fetal tone (FT), by the brain cortex, fetal movements (FM), by the cortex and nuclei, fetal breathing (FB) movements, by the centers in the fourth ventricle, and NST, by the posterior hypothalamus and medulla [1,2]. The last component, amniotic fluid, reflects adequate perfusion of the fetal kidneys.

Vintzileos et al. defined acute and chronic markers of the fetal condition: NST, FB, FM and FT are the acute markers, and amniotic fluid is a chronic marker [3,4]. Fetuses with a decreased AF are at high risk of cord accidents, even if the rest of the parameters are normal. Thus, a biophysical score of 8 in a fetus with oligohydramnios is more worrisome than a score of 6 in a fetus with a normal amount of amniotic fluid.

In 1991, we proposed a new scoring system: a "weighted" Fetal Biophysical Profile score based on the importance of individual parameters. Each component of the biophysical profile is scored according to its importance. Amniotic fluid (AF), if adequate, is scored 4; the non-stress test (NST) if reactive, 3; fetal breathing, 2; fetal movement, 1; and finally fetal tone, 0. According to this weighted system, the maximum fetal biophysical score (FBS) is 10, minimum 0. Six hundred high-risk pregnancies were retrospectively assessed using the "traditional" and "weighted" biophysical scoring systems. The "weighted" biophysical score has a better correlation with neonatal outcome than the "traditional" score. A "weighted" biophysical score of 8 and above was associated with a favorable outcome in all cases. A "traditional" score of 8 and above was also assigned to fetuses who were later found to be hypoxic. An unfavorable fetal outcome correlated in a more consistent fashion with the "weighted" score than with the "traditional" score.

Currently, modified FBP is used in many obstetrical services worldwide [5].

Table 1. reflects the correlation between weighted Fetal Biophysical Profile Score (FBP) and perinatal outcomes.

Weighted Score	Favorable Outcome	Unfavorable Outcome
10	100%	0%
8	100%	0%
6	95%	5%
4	52%	48%
2	12%	88%

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In Utero Meconium Aspiration Using Endoscopic Technology

The word "meconium" is derived from the Greek mekoni, which means "opium-like", referring to the belief that meconium leads to neonatal depression, a concept generally attributed to Aristotle [1]. Meconium is the fetal colonic content, which is composed of water (72 to 80%), exfoliated skin cells, lanugo and vernix caseosa [2].

Risk factors for meconium-stained amniotic fluid include post-term pregnancy, prolonged labor, chorioamnionitis, fetal growth restriction, preeclampsia, oligohydramnios, and intrahepatic cholestasis of pregnancy. Meconium-stained amniotic fluid during labor has been linked to fetal acidemia, neonatal respiratory distress, and seizures as well as cerebral palsy.

Hypoxia is widely considered a mechanism responsible for fetal defecation and meconium-stained amniotic fluid. However, many fetuses with meconium-stained amniotic fluid do not have fetal acidemia [3]. Thick meconium is associated with higher rates of abnormal fetal heart tracings, neonatal intensive care unit admission, need for neonatal ventilation, hypoxic-ischemic encephalopathy, small for gestational age, and low APGAR scores. [4].

Prophylactic intrapartum transcervical amnioinfusion was proposed to reduce the rate of MAS and other adverse neonatal outcomes. Subsequently, this procedure was abandoned after the publication of a meta-analysis that reported no evidence of benefit. (4) Light amniotic fluid staining may represent a physiological excretion of meconium- a normal fetal activity [5].

Several approaches have been proposed to remove meconium from the neonatal airways to prevent aspiration. Routine endotracheal intubation was introduced in the 1970s. Other investigators advocated the removal of meconium from the oropharynx and nasopharynx before the delivery of the chest. This procedure was performed with a bulb syringe. The combined approach consisted of immediate oro/nasopharyngeal suctioning at the time of delivery of the fetal head. This management was reported to reduce the rate of MAS from 1.9% to 0.4% [4].

Lately, consensus has emerged that infants born to mothers with MSAF should no longer routinely receive suctioning at birth. The current recommendation is that management should be guided by general neonatal resuscitation principles [6].

We share our experience with the first ever attempt to provide in-utero suctioning of thick meconium. In-utero meconium suctioning under direct visualization was successfully performed in 11 fetuses in whom thick meconium was detected upon rupture of membranes. A gas-sterilized flexible fiberoptic scope with an operational channel was introduced through the cervix, and meconium was aspirated from the fetal mouth. Definitive suction was performed in all neonates immediately after birth, and endoscopic meconium suctioning was successfully performed in 11 out of 16 fetuses with retrieval of 3 to 12 mL of thick meconium. Only one neonate in the series had meconium below the vocal cords, and none developed meconium aspiration syndrome postnatally [7].

Since its introduction in 1978, intrapartum fetal endoscopy has been successfully used to determine the pathology of the umbilical cord and to assess the integrity of uterine scars during a VBAC. (8,9) The new application of fetal endoscopy has not only been shown to be safer for both the mother and the fetuses but may have therapeutic efficacy as well.

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Combination of Abdominal Plastic Procedures with Cesarean Section: Is it Safe?

Traditionally, a combination of cesarean section with any other surgical procedures has not been accepted. The reason for such an opinion has been the fear of complications of combined procedures (infection, hematomas, poor wound healing). None of these concerns have been supported by well-designed research studies. The advantages of combining a cesarean section with other surgical procedures are obvious; elimination of additional anesthesia, increased patient satisfaction, avoidance of a second surgery, not to mention the financial benefits. We report 52 patients who underwent a combination of cesarean section with other procedures (panniculectomy, abdominoplasty, hernia repair, myomectomies, ovarian biopsies, et cetera). The following post-surgical outcomes were included in the analysis: post-surgical fever, presence of seromas, hematomas, and wound dehiscence. Post-surgical fever was defined 24 hours or above or equal to 38.7 Celsius or 101.6 Fahrenheit for the first 24 hours or above 38 Celsius, 100.4 Fahrenheit on any 2 of the first 10 days [1].

The frequency of postpartum fever was 20% in the study group versus 22 % in the control group. Seromas were present in 9% versus 8%; hematomas, 7.6% versus 5.5%, and wound dehiscence took place in 5.4% versus 8% in patients with high BMI. Patients with normal BMI who underwent a combined procedure had similar rates of complications: 6.2% versus 4% for postpartum fever, 1.2% versus 0.8% for seromas, 8.2% versus 4% for hematomas, and 2.4% versus 0.3% for wound dehiscence [2].

We concluded that the performance of panniculectomy and tummy tuck as part of a cesarean section does not appear to increase surgical complications in patients with a high BMI. According to the American Society of Plastic Surgeons, over 324,000 liposuction cases and 135,000 abdominoplasties are performed annually.

The limitations of the study were a limited number of complications we looked for (postpartum fever, seromas, hematomas, and wound dehiscence). The relatively small sample size increases the probability of a type II error (failure to reject the null hypothesis, when it is false).

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In Utero Surfactant Treatment in Preterm Fetuses

Once the causes of respiratory distress syndrome (RDS) became known, exogenous surfactant administration became effective evidence-based treatment for RDS in preterm infants [1].

Currently, surfactant administration is done while the infant is breathing on nCPAP using a 5-6 French feeding tube to pass into the trachea via the vocal cord, 1-2 cm under direct laryngoscopy. The surfactant is given in a dose of 200 mg/kg within 1-3 minutes in small boluses.

There is a consensus that the earlier surfactant therapy is started, the better the outcome [3]. The effect of the timing of surfactant administration on the course of RDS has been confirmed. Maeda et al [4]. demonstrated a significant improvement in the respiratory status of baboons who received

surfactant within 10 minutes of birth compared to those who received surfactant at 2 hours of age.

These data led to attempts at in-utero intervention. Intra-amniotic administration of surfactant was associated with improvement in the clinical course of preterm baboons, as shown by increasing PaO2 and by decreasing oxygen requirements [4]. A better outcome in the in-utero treatment group is not surprising since these fetuses receive surfactant before the initiation of respiration. At this stage, pulmonary alveoli are still filled with lung fluid, and the phospholipid suspension may reach the alveoli. In 1995, we used transcervical endoscopy to deliver surfactant directly to the fetus after spontaneous rupture of membranes in active preterm labor.

A gas-sterilized intraoperative fiberscope was introduced through the cervical canal. The flexible fiberscope was inserted under constant endoscopic visual control to avoid possible trauma to the fetus and the mother. Surfactant was injected into the mouths of three preterm fetuses through a catheter placed through the biopsy channel.

Fetal heart rate tracing as well as neonatal and maternal outcomes were reported for each case. In-utero surfactant placement was successful in each case. All treated fetuses were born between 28 and 33 weeks of pregnancy with only mild RDS. Treatment continues to be experimental with long-term results still pending.

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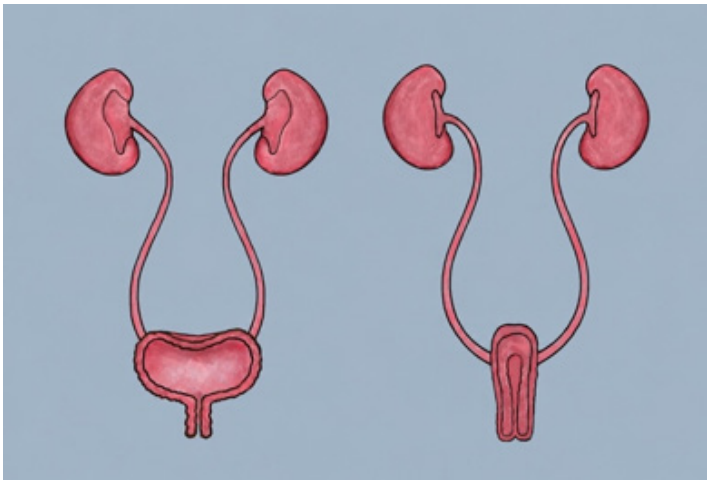
Dilated Fetal Renal Pelvis: Normal or Abnormality?

Hydronephrosis or fetal pyelectasis is the dilation of the renal pelvis. A fetal renal pelvis is typically considered dilated when it measures 4 millimeters or greater during the second trimester of pregnancy. Dilated pelvis is a sonographic "soft" marker that could indicate increased risk for Down syndrome. While often transient, it warrants close monitoring. Mild hydronephrosis is found in approximately 13.9% of Down syndrome fetuses compared to only 1.7% of normal fetuses.

In collaboration with Margaret Cuomo, MD, from the Department of Radiology at North Shore University Hospital, we reported an important finding: the presence and degree of fetal hydronephrosis is dependent on the condition of the fetal bladder, whether full or empty. When the fetus is emptying its bladder, the degree of fetal hydronephrosis either diminishes or completely disappears. Thus, the status of the fetal bladder should be considered when evaluating fetal hydronephrosis.



Dilated renal pelvis when bladder is full (image on the left), normal renal pelvis with an empty bladder in the same fetus (image on the right).

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Individual Approach to Estrogen Replacement Therapy: One Size Doesn't Fit All

Hormone-replacement therapy (HRT) has undergone many changes since it was first introduced into clinical practice in the 1940s. HRT decreases the incidence of menopausal symptoms, risk of osteoporotic fractures, and improves the overall quality of life. In younger, healthy women (aged 50-60 years), the risk-benefit balance is in favor of using HRT [1-3]. However, HRT is not risk-free. An increased risk of stroke with HRT has been reported as well as risk of breast and endometrial cancer. HRT was very popular until 2002 when alarming results from the Women's Health Initiative were released, alerting to the increased risk of breast and uterine cancer, heart disease, and dementia in HRT users. Lately, follow up analysis detected multiple flaws in the original study. Firstly, study participants were much older than women who typically start HRT and may have had preexisting disease. Secondly, HRT today uses different formulations and methods of administration.

The FDA started extolling HRT as "lifesaving" and removed a longstanding safety warning. The change in the FDA stance was followed by a 30% jump in patch use. More than 1 million American women start menopause each year. Over the past two years, they have increasingly sought out HRT patches to treat mood swings, hot flashes, and sleep disturbances, along with vaginal dryness, osteoporosis, decreased libido, etc. However, an individual approach to HRT is of the utmost importance, with the goal of administering the minimal effective dose in each case.

We propose a computer software program to provide individual therapy to postmenopausal women based on the following parameters: Age, weight, uterine status (present, absent), and individual hormonal levels. Those parameters were chosen because they appear to be most important in treatment outcomes. The computer program was designed to develop the minimal effective dose of HRT to control patients' symptoms. The project was done in collaboration with M. Tsykin, CTO International Support and Development, Fujitsu, Australia.

The program calculates the minimal required portion of the HRT transdermal patch to be administered to accommodate an individual patient's treatment needs after all her data has been entered into the system. In practice it works as follows: Patient completes the questionnaires and blood is collected all at the first visit. All the results are loaded into the computer, and the algorithm suggests the appropriate dose of medicine. Below is a practical example of computer-assisted patch use:

Patient X
a. Age: 56
b. Weight: 73 kg
c. Uterus: removed
d. Menopausal symptoms: severe
e. Hormonal levels:
a. FSH: 40 mlU,mL
b. Estradiol: 30 pg/mL
c. Testosterone: 15 mg/dL
f. Recommended dose: 87% of the patch surface square

The same patient 10 years later:
a. Age: 66
b. Weight: 82 kg
c. Menopausal symptoms: minimal to none
d. Recommended dose: 28% of the patch square surface

In summary, we report our experience with the utilization of a computer program for an individual approach to HRT. The program does not prescribe HRT but adjusts the dose to the needs of the individual patient. Because benefits and side effects are usually dose related, the goal of the program is to offer the minimally effective dose. The decision of when and if a patient should be started on HRT remains solely hers and her healthcare providers.

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Fetal Intubation in Management of Nearly Fatal Shoulder Dystocia

The majority of shoulder dystocia cases can be resolved within minutes by the sequential use of the McRoberts maneuver and suprapubic pressure, rotational maneuvers, and the delivery of the posterior arm [1]. However, severe shoulder dystocia may lead to severe fetal hypoxia and death. In cases of severe shoulder dystocia, compression of the neck causes venous obstruction, aggravated by vagal stimulation and fetal bradycardia. When all the efforts to resolve shoulder dystocia are fruitless, the Zavanelli maneuver is the last hope. It consists of cephalic replacement with subsequent delivery by cesarean section. However, the Zavanelli maneuver is not always helpful and in the best-case scenario, requires additional time [2]. We encountered a case where severe shoulder dystocia could not be resolved despite numerous efforts. The baby's head became purple, and the baby was gasping for air. At this point, we decided to perform fetal intubation to allow more time for the resolution of shoulder dystocia while maintaining fetal oxygenation. Intubation of the fetus before severing the umbilical cord has previously been reported and named the EXIT procedure. The EXIT procedure offers the advantage of ensuring uteroplacental gas exchange while on placental support [3]. Fetal intubation gives us an extra 45-60 minutes of working time to resolve shoulder dystocia while the fetus has uteroplacental perfusion [4, 5].

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New Fetal Assessment Method: Maternal Exercise

Current modalities in antepartum fetal surveillance had been developed in the 1970s. Most of these tests are not designed to assess fetal reserves. The only existing test of occult placental insufficiency is the oxytocin challenge test (OCT) which requires administration of oxytocin to cause uterine contractions [1]. Today OCT is rarely, if ever, used because of its complexity (need for IV access, etc.) and possible side effects (preterm labor). In 2008, we proposed a novel test to assess fetal reserves in high-risk pregnancies [2-4]. For maternal exercise, we used a motorized treadmill in a moderate regimen (15-minute fast walk at a speed of 3 mph with an incline of 25 degrees). The research protocol was approved by the Institutional Review Board of NY Downtown Hospital (North America study group) and Helsinki Committee (Moscow University School of Medicine). All participants signed an informed consent form. As soon as the exercise program was finished, the pregnant mothers were subjected to fetal testing (NST, BPP) to assess fetal reserves.

The results of fetal response to maternal exercise fall into two categories: negative (normal) or positive (abnormal). Fetal heart rate (FHR) in response to maternal exercise exhibited transient tachycardia, normal beat to beat variability and absence of decelerations (negative results). Results were labeled positive if the FHR tracing showed decelerations (late or persistent variables or sustained bradycardia). Adverse fetal outcomes were considered if one or more of the following were present: Category III FHR tracing, 5-minute Apgar score of less than 7, admission to the neonatal intensive care nursery (NICU) unrelated to prematurity, fetal growth restriction, and fetal and early neonatal demise except for SIDS. The most common complication in fetuses with positive prenatal test results was abnormal FHR in labor (36%) followed by low Apgar score (21%) and need for NICU admission (19%).

In conclusion, maternal exercise causes changes in FHR, which may be used to assess fetal reserves. It can be used to detect chronic placental insufficiency in high-risk patients and replace OCT.

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Cite this article: Boris M Petrikovsky. (2026) A Legacy of the Firsts. Advance Medical & Clinical Research. 7 (3): 384-388.

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