

Preoperative assessment in the pregnant patient

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Background: Pregnant women have the real possibility of undergoing surgical interventions or invasive procedures related to pregnancy or non-obstetric conditions. Preoperative assessment is a priority to identify risk factors and prevent adverse maternal-fetal complications. The internist, the cardiology specialist, the intensive care physician and the anesthesiologist are responsible for preparing the preoperative assessment and issuing recommendations.

This review includes the physiological changes of pregnancy and their clinical implications regarding the anesthetic technique and the surgical approach, the most relevant aspects of preeclampsia-eclampsia and cesarean section, the preoperative management of the patient who is a candidate for pregnancy-related surgery, and also with non-obstetric surgery. The evaluation scales that are most frequently used are reviewed, mainly those that take into account the condition of the pregnancy and also the safety of the drugs with respect to the fetal risk.

Keywords: Pregnancy; Preoperative assessment; Obstetric surgery and pregnancy; Non-obstetric surgery and pregnancy; Maternal-fetal outcome, High-risk pregnancy.

PHYSIOLOGICAL CHANGES OF PREGNANCY AND THEIR CLINICAL INTERPRETATION

Important maternal changes occur during pregnancy to optimize fetal growth and development and to ensure successful birth outcomes, but they may also increase maternal risk during anesthesia and surgery. The multidisciplinary team must be aware of the changes in order to properly interpret them, identify the true complications, and establish timely management to reduce maternal and fetal morbidity and mortality.

Cardiovascular changes

In pregnancy, cardiac output increases by 40% and plasma volume also increases, which produces dilutional anemia. The heart rate increases by 10% and vasodilation occurs with a reduction in blood pressure. It is a hyperdynamic state that becomes more evident as the placenta develops because it behaves like a large arteriovenous fistula because its structure lacks resistance vessels. The hypotensive response is increased by general and spinal anesthesia.

Normal cardiovascular changes are reflected in clinical, electrocardiographic, radiological, and echocardiographic findings. The data are: more intense arterial pulses, displacement of the cardiac apex shock up and to the left, splitting of the second heart sound,

systolic murmur in the pulmonary and tricuspid focus, greater intensity of pre-existing murmurs, systolic-diastolic murmur heard in one or more both breasts ("soufflé"), electrical axis rotation to the left, left atrial dilatation, inverted Q and T waves in DIII, Q wave in aVF, inverted T wave in V1 to V3, cardiac widening on chest x-ray and posterior pericardial effusion in minimal amounts as an echocardiographic finding.

Changes may reveal heart failure, congenital heart disease, cardiomyopathy of pregnancy, endocarditis, lupus, or pulmonary thromboembolism. Imaging studies should be used to document the differential diagnosis. Maternal exposure for a chest X-ray does not increase the teratogenic risk and the echocardiogram can be repeated several times during pregnancy.¹

Respiratory changes

The growing uterus pushes up on the diaphragm restricting its movements reducing functional residual capacity by 20% when the patient is standing and by 50% to 70% when in recumbent position. Minute volume and tidal volume increase by approximately 35% which predisposes to respiratory alkalosis, but this does not occur due to the compensatory effect of physiological bicarbonaturia. Pulmonary changes produce a more rapid induction

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Scales	Year	Description	Pregnancy dates
Goldman scale ¹⁰	1971	Global evaluation for non-cardiac surgery	No
ACC/AHA scale ^{11,12}	2007 2014	Cardiology evaluation for patients undergoing non-cardiac surgery	No
Lee index ¹³	1999	Evaluation scale to predict cardiologic complications in non-cardiac surgery.	No
CARPREG study ¹⁴	2001	Predictive index of adverse cardiac events in women with pregnancy and heart disease	Yes
CARPREG II scale ¹⁵	2018		
NYHA functional classification ¹⁶	1928 2014	Functional classification of patients with heart failure	No
ASA physical status classification ^{17,18}	1941 2020	Classification of preoperative physical status in the open population and pregnant women	Yes
Caprini scale ¹⁹	2001	Thromboembolic disease prophylaxis	Yes
Detsky index ²⁰	1986	Goldman simplified multifactorial cardiac risk index for patients undergoing noncardiac surgery	No
Wells scale ²¹	1997	Estimates the probability of suffering deep vein thrombosis	No
Ginebra scale ^{22,23}	2001 2006	Clinical index to determine the probability of pulmonary thromboembolism	No

ACC: American College of Cardiology, AHA: American Heart Association, CARPREG: Cardiac disease in pregnancy, NYHA: New York Heart Association, ASA: American Society of Anesthesiologists,

Table 1. Perioperative assessment scales and pregnant patients

Urological and renal changes

with inhalation anesthesia. Tachypnea is usual, but if sudden accelerations in ventilation occur, pulmonary thromboembolism must be ruled out.

During surgery, women with a third-trimester pregnancy should be placed in the left lateral decubitus position to avoid compression of the vena cava and with a 30° lateral Fowler tilt to improve lung mechanics and prevent intraoperative aspiration. Gentle elastic bandaging of the legs is mandatory because most thrombi originate in the soleus arch veins during surgery and manifest as thromboembolism when the physician orders the patient to stand up to walk.

Endotracheal intubation fails in one of 300 cases with pregnancy due to airway edema. Delayed ventilatory support from difficult intubation, reduced functional residual capacity, and reduced oxygen delivery to tissues from dilutional anemia may have catastrophic consequences for the maternal-fetal binomial. Anesthesiologists use the Mallampati classification of 4 classes to assess the airway. Class 3 is the case of a patient sticking out the tongue in which the soft and hard palate and the base of the uvula are visible, but the tonsils are not. When only the hard palate is seen it indicates a higher probability that the ventilation mask may be insufficient and that endotracheal intubation will be difficult. For patients in this class, all respiratory protection measures must be taken, including the permanent supply of oxygen and the use of smaller endotracheal tubes with flexible guides with the intubation maneuver directed with fiber optic equipment. Despite conventional fasting, the pregnant patient should be considered with a full stomach due to slow gastric emptying.¹²

In pregnancy, pyelocalyceal dilatation and vesicoureteral reflux occur which predispose to urinary infection. Glomerular filtration increases up to 50% due to the increased blood supply, reduction in blood pressure, and greater intrarenal capacitance that produces an increase in renal dimensions and a state of physiological hyperfiltration that leads to lower blood values of urea, nitrogen from urea, creatinine and uric acid compared to the open population.

Dilutional hypoalbuminemia occurs and the serum calcium level falls, but the ionized calcium level remains normal. The tubular supply of fluid and solutes is increased so that the proximal convoluted tubular systems for recovering amino acids, protein, glucose, and bicarbonate are overwhelmed. Glycemic control according to the urinary result using test strips is not recommended during pregnancy. The same is true for documenting proteinuria.¹

Hematological changes

The total mass of red blood cells increases, but is exceeded by the increase in plasma volume causing dilutional anemia. It should be kept in mind that pregnancy is a hypercoagulable state because the synthesis of coagulation factors I, II, V, VII, VIII, X, and XII is increased and the components of the fibrinolytic system are reduced.

The data support the use of low molecular weight heparin in prophylactic doses to prevent deep vein thrombosis in the perioperative period. The use of unfractionated heparin is not recommended because the safety profile of low molecular weight heparin is superior in pregnancy, it has a lower risk of bleeding, thrombocytopenia and osteoporosis, it has better

Predictor	Score
History of cardiac events or arrhythmia	3
NYHA class III/IV or cyanosis	3
Mechanical heart valve	3
Decreased ventricular function	2
History of mitral or aortic valve dysfunction	2
Pulmonary hypertension	2
Coronary artery disease	2
Aortic disease	2
Late pregnancy assessment	1
No previous interventions for existing cardiac problems	1

Score	Percentage of adverse cardiac events
0 to 1	5%
2	10%
3	15%
4	22%
>4	41%

NYHA: New York Heart Association

Table 2. Risk index for heart disease in pregnancy CARPREG II

bioavailability, it does not cross the placenta, it has less inactivation by tissue proteins due to their smaller molecular size and their half-life and volume of distribution increase in pregnancy. The blood group and Rh of the mother and the fetus must be known to regulate the administration of immunoglobulin anti-D as a preventive maneuver for maternal-fetal isoimmunization.

Parenteral iron supplementation using any of the current hypoallergenic compounds is justified to correct iron deficiency anemia with hemoglobin <8 g/dL in patients with a pregnancy greater than 34 weeks and the transfusion of only one unit of erythrocytes is indicated when the hemoglobin concentration it is <6 g/dL in a patient without bleeding. In the patient with bleeding, there is no hemoglobin level as a cut-off point for transfusion.¹

Gastrointestinal changes

During pregnancy, gastroesophageal reflux and the opportunity for bronchial aspiration are more frequent because the tone of the lower esophageal sphincter is reduced and gastric motility is slow. Fasting for 8 hours, elevation of the head of the patient's bed by 15°, and the use of prokinetic and antacid drugs, but without aluminum and magnesium contained in a preparation such as suspension or gel, are justified to prevent chemical pneumonitis from vomiting and bronchial aspiration. The pregnant patient must be considered at all times as a patient with a full stomach, so intubation must be rapid using

a smaller caliber tube with the assistance of a flexible guide or with fiber optic equipment.

In pregnancy, liver function tests show increased values of the enzyme alkaline phosphatase from its synthesis of placental origin, the changes include a reduction in the concentrations of bilirubin, albumin and globulin due to plasmatic dilution.¹

Endocrine changes

The thyroid gland increases in size and becomes palpable; this finding should not necessarily be interpreted as a pathological goiter. A thyroid-carotid murmur may be detected on local auscultation. The blood values of thyroid hormones have quarterly variations, so the results must be compared with the pre-established standards. The chorionic gonadotropin hormone increases in the initial stage of pregnancy and then decreases, it is involved in hyperemesis gravidarum. Because its structure is similar to that of thyroid-stimulating hormone, cases of hyperemesis and hyperthyroidism must be differentiated with true organic processes that are resolved only with surgery or some type of intervention.

At the beginning of pregnancy, the cells of the pancreatic islets hypertrophy and the insulin level increases, so hypoglycemia can occur. Energy intake with glucose should be considered when intravenous solutions are prescribed in a patient with prolonged fasting. In later stages, maternal peripheral resistance to insulin occurs and gestational diabetes can emerge in cases with risk factors and a predisposing genetic

Class	Definition	Examples in obstetrics
I	Normal healthy patient	None
II	Patient with mild systemic disease	Normal pregnancy, well controlled gestational hypertension, well controlled preeclampsia without severity data, gestational diabetes mellitus controlled with diet
III	Patient with a severe systemic disease	Severe preeclampsia, gestational diabetes mellitus with complications or insulin requirements, atherothrombotic disease requiring anticoagulation
IV	Patient with severe systemic disease that compromises life	Severe preeclampsia complicated by HELLP syndrome or other adverse events, peripartum cardiomyopathy with LVEF < 40%, uncorrected or decompensated congenital or acquired heart disease
V	Dying patient who is not expected to survive without the operation	Uterine rupture
VI	Brain dead patient potential organ donor	None

Letter E: must be added to describe the case as an emergency

Letter G: must be added to indicate that it is a pregnant woman

Table 3. Current definitions and approved examples of the 2020 American Society of Anesthesiologists classification of physical status.

load. Glycemic control with serial blood samples for continuous insulin therapy is adequate; glycosuria is not recommended as the therapeutic guide.

The placenta produces corticotropin-releasing hormone that increases corticotropin and cortisol production, making it impossible to identify whether their elevated values in a serum or saliva sample correspond to a normal result or a pathological state.¹

PREOPERATIVE ASSESSMENT IN PREECLAMPSIA-ECLAMPSIA

Preeclampsia-eclampsia is the hypertensive state that most frequently complicates human pregnancy. It appears from week 20 onwards, in the peripartum stage or in the puerperium. The cut-off point to document arterial hypertension in pregnancy is $\geq 140/90$ mmHg, mild preeclampsia includes values $\geq 140/90$ mmHg, but $< 160/110$ mmHg without alterations in maternal organs. Severe preeclampsia implies blood pressure $\geq 160/110$ mmHg or less, but always accompanied by changes in the brain, lungs, heart, kidneys, liver, or coagulation system. Eclampsia is characterized by the appearance of generalized tonic-clonic seizures in a patient with preeclampsia whose seizure cause cannot be labeled to a different disease. HELLP syndrome involves hemolysis, elevated liver enzymes, and thrombocytopenia complicating severe preeclampsia or eclampsia.

The recommendation of the experts is that the management of severe preeclampsia, eclampsia and HELLP syndrome should be carried out in the Intensive Care Unit of a tertiary care center. Initially, the therapeutic is of the medical order to achieve maternal stabilization and interrupt the pregnancy to offer the best conditions for the birth of the fetus.

In our setting, it has been proposed that maternal stabilization should include nine goals: 1) mean arterial pressure ≤ 95 mmHg, 2) central venous pressure 6 to 10 cm of water, 3) uresis 1.5 to 2

ml/K/hour without diuretic, 4) glycemia < 160 mg/dL, 5) plasmatic colloid osmotic pressure 24 ± 2 mmHg, 6) arterial pH 7.37 to 7.44, 7) hemoglobin 10 to 14 g/dL, 8) $\geq 100,000$ platelets/ μ L, and 9) absence of seizures.³ Anesthesia and surgery are much safer if blood pressure control ($\leq 140/90$ mmHg) is achieved, uresis restored without the use of a diuretic agent (1.5 to 2 mL/K/hour), hemoglobin level greater than 10 g/dL and platelet count $\geq 50,000$ platelets/ μ L.

The termination of the pregnancy should be scheduled to the extent possible except in cases of a real emergency. Neuraxial anesthesia and cesarean section are the most frequently used methods due to their few systemic and fetal effects and due to technical safety and better bleeding control, respectively. Postpartum management in a critical care ward with the participation of a multidisciplinary team is necessary to improve maternal and fetal outcomes.³

OBSTETRIC SURGERY DURING PREGNANCY

During pregnancy, obstetric surgery can wait and be performed after the end of the pregnancy. Emergency conditions must be analyzed individually, always assessing the risk-benefit. Regarding the causes of obstetric surgery, the following distribution has been reported: adnexal tumors 10 to 50%, ectopic pregnancy 10 to 15%, cervical neoplasia and need for biopsy 1 to 25%, and biopsy for breast cancer 0.3%. Minor, but equally important procedures such as cervical cerclage and amniocentesis should be performed if fully warranted.

The evaluation of an anesthetic procedure and the type of surgery are the responsibility of a multidisciplinary team that must include an expert in emergency obstetric surgery to decide the appropriate moment and the safest technique. Informed consent with the authorization of the patient or the family member directly responsible is a necessary requirement for anesthesia and surgery, respectively.⁴

Drugs	Fetal effect	Recommendation
Sedatives or hypnotic Propofol Ketamine Diazepam	Cardiac depression "in utero" Neonatal cardiac and respiratory depression	Avoid high doses Fetal monitoring Alert for neonatal ventilatory support
Anesthetic gases Nitrous oxide	Spontaneous abortion Possible impairment of neural development	Avoid it or use low doses and elimination systems
Muscle relaxants	They do not cross the placental barrier	Can be used
Opioids	Congenital heart disease Neonatal respiratory depression Neonatal abstinence syndrome	Avoid them
Non-steroidal anti-inflammatory	First trimester miscarriage Second trimester congenital cryptorchidism Kidney injury In utero and neonatal kidney injury Constriction of the ductus arteriosus	Avoid them
Aspirin	No teratogenic effect has been shown An increased risk of intrapartum bleeding has not been demonstrated	Can be used
Local anesthetics Cocaine	Proven teratogenic effect Placental abruption	Avoid them
Vasopressors Ephedrine Phenylephrine	Increased maternal blood pressure	Can be used
Ionizing radiation	Proven teratogenic effect No effect with dose ≤ 5 rad Mental retardation with high doses between 8 to 15 weeks gestational Lower risk of leukemia	Avoid them, if necessary assess the risk-benefit
Radioactive isotopes with Iodine	Fetal and neonatal abnormal thyroid function	Contraindicated in pregnancy
Radiotracers for diagnostic studies	Possible deterioration of fetal organs	Avoid them

Table 4. Fetal risk of drugs administered during anesthesia.

NON-OBSTETRIC SURGERY DURING PREGNANCY

Minimally invasive procedures and nonobstetric surgery should be deferred until the end of the pregnancy unless the patient's life is in danger. The prevalence of non-obstetric surgery during pregnancy is 1 to 10 cases per 1,000 pregnancies. The most frequent causes of non-obstetric surgery during pregnancy are: non-abdominal trauma 4%, major abdominal trauma 2.5%, acute cholecystitis 1.18%, appendicitis 1.05% and intestinal obstruction 0.3%. Cancer surgery, neurosurgery, and cardiac surgery have also been reported. Minimally invasive procedures include endoscopies such as colonoscopy, cardiac catheterization, and interventional cerebral catheterization.⁴ In all cases, preoperative assessment should be requested.

In 2017 Balinskaite et al.⁵ estimated the risk of adverse effects to pregnancy following nonobstetric surgery in a retrospective cohort of 6.5 million of pregnant patients seen from April 1, 2002 to March 31, 2012 in United Kingdom hospitals. They found an increased risk of adverse birth outcomes, although the attributable risk was generally low. The authors reported that for every 287 surgical operations 1 fetal death occurred, for every 31 operations 1 premature

birth was associated, for every 39 operations a fetus with low birth weight occurred, for every 25 operations there was the need for 1 additional cesarean section and by every 50 interventions there was 1 case with a long hospital stay.

Additionally, Fu et al.⁶ studied 23,721 pregnancies whose data were contained in a database of hospitals in Taiwan, China and identified 4,747 patients undergoing non-obstetric surgery. The authors found higher risks of prematurity, low birth weight, low Apgar scores, neonatal and infant death, longer hospital stay, and higher medical expenses than those pregnant women without surgery. Furthermore, surgery in the third trimester was associated with a higher rate of fetal effects than surgery performed in the first trimester.

When surgery is required, the mandatory recommendation is that an obstetrician should be part of the surgical team.⁷ In general, the preoperative assessment is similar regardless of whether the woman is pregnant, but it should be considered that the physiologic changes of pregnancy may increase anesthetic and surgical risk. Special management considerations include pregnancy-related measures, laboratory changes, timing of surgery, choice of anesthetic method, intubation precautions, patient positioning, identification of blood group and Rh

factor, having units of blood in reserve from the preoperative period, maternal and fetal monitoring, and thromboembolism prophylaxis.⁸

Emergency surgery should never be denied to a pregnant woman if necessary and should not be delayed regardless of the gestational trimester because this may negatively affect the outcome of the pregnant woman and fetus. When it comes to a necessary but elective surgery, the recommendation is to perform it 6 weeks postpartum.⁹

PREOPERATIVE RISK SCALES

To determine the preoperative risk in pregnant women requires the integration of risk scoring scales, the identification of individual factors, and the application of clinical judgment. The most important classifications are shown in **Table 1**. As can be seen, not all the scales include pregnancy data to calculate the score for their evaluation, but all the classifications can be applied to the population of pregnant women once they apply the appropriate clinical judgment according to the needs of the case. The patient can benefit from the complementary application of various scales.

Goldman scale

In 1977, Goldman et al.¹⁰ introduced a multifactorial cardiac risk scale in patients who were candidates for non-cardiac surgery. The scale includes classes I, II, III and IV of cardiologic risk according to the score of pre-established clinical and laboratory parameters. The classes are correlated with the percentage of mortality. When an evaluation is issued with this scale, the evaluation parameters must be transposed to the condition of the pregnant patient, since the original scale and the modifications that have been proposed do not include this group of patients. Clinical judgment is necessary to properly classify them.

ACC/AHA scale

The American College of Cardiology and the American Heart Association (ACC/AHA) issued guidelines for preoperative cardiologic evaluation in cases requiring non-cardiac surgery in 2007 and 2014. The committees made the same recommendations for pregnant and non-pregnant patients. The scale awards points and concludes in three categories: High risk (reported risk of cardiac death or non-fatal myocardial infarction frequently greater than 5%), Intermediate risk (reported risk of cardiac death or non-fatal myocardial infarction generally 1 to 5 %) and Low risk (reported risk of cardiac death or non-fatal myocardial infarction generally less than 1%) which

includes patients who generally do not require further preoperative cardiac testing.^{11,12}

Revised Cardiac Risk Index (Lee)

This is a scale for predicting the occurrence of cardiac complications in non-cardiac surgery. It was proposed by Lee et al.¹³ after studying 4,315 patients

older than 50 years who underwent major noncardiologic surgery. Major cardiac complications that appeared after surgery were evaluated. The patients studied by Lee et al.¹³ cannot be considered an average cohort of "non-cardiovascular surgery surgical patients" since they included a large number of patients undergoing orthopedic surgery and excluded neurosurgery patients. However, the area under the ROC curve of the data set used for validation is 0.81, which indicates that the index has a good capacity to discriminate between patients with and without risk of serious cardiac events. The index has four categories: class I with 0 risk factors corresponds to a 0.4% probability of complications, class II with 1 risk factor 0.9%, class III with 2 risk factors 6.6% and class IV with 3 or more risk factors. risk 11%.

CARPREG II scale

In 2001, Siu et al.¹⁴ conducted a multicenter prospective study of pregnancy outcomes in women with heart disease called CARPREG. The authors found a significant percentage of cardiac and neonatal complications despite the necessary obstetric and cardiology care. They concluded that maternal cardiac risk could be predicted using a risk index. In 2018, Silversides et al.¹⁵ published the results of the CARPREG II study and proposed a predictive index of adverse cardiac events in women with heart disease and pregnancy. **Table 2**

NYHA functional classification

This is a scale proposed by the New York Heart Association (NYHA) used as a method for the functional classification of patients with heart failure. It was proposed in 1928 and revised several times, the last in 1994. It designates 4 classes (I, II, III and IV) based on the limitations in the patient's physical activity caused by cardiac symptoms. Class I: without limitation. Regular physical activities do not cause dyspnea, tiredness, or palpitations. Class II: slight limitation of physical activity. The patient is well at rest, regular physical activity causes dyspnea, tiredness, palpitations or angina. Class III: marked limitation of physical activity. The patient is well at

rest, but minor activities cause symptoms. Class IV: incapacity for any physical activity without symptoms. The symptoms are present even at rest. With any activity they increase.

To increase the objectivity of the classification, the four 4 classes have been described as A, B, C and D since 1994. The assessment is determined through the interpretation of the electrocardiogram, stress test, X-rays, echocardiogram and special images. Class A: No objective evidence of cardiovascular disease. Class B: Objective evidence of minimal cardiovascular disease. Class C: Objective evidence of moderately severe cardiovascular disease. Class D: Objective evidence of severe cardiovascular disease. However, this new classification is also made based on appreciation judgments since there are no criteria for the use of the terms "minimal", "moderately severe" and "severe" disease.¹⁶

ASA Physical status classification

In 1941, the American Society of Anesthetists, an organization that later became the American Society of Anesthesiologists (ASA) developed a six-category classification for patients requiring anesthesia and surgery.¹⁷ The ASA fitness classification was further modified into five categories in 1961 and remains in use today with some changes. Its application in the obstetric population has caused special controversy because the physiological changes of pregnancy make pregnant women different from non-pregnant women, despite the fact that pregnancy is not considered a disease. For this reason, no pregnant patient should be staged as class I. The woman with an uncomplicated pregnancy is assigned as ASA class 2 because gestational changes can cause a problem even when the pregnancy is not a disease. The 2020 version already includes the adult population, pediatric patients and pregnant women.

Table 3 shows the classification with the examples of obstetric cases to guide the evaluator. The letter E added to each class stands for emergency surgery. An emergency is defined as existing when the delay in the treatment of the patient threatens his life or the possibility of the loss of any part of the body. Barbeito et al.¹⁸ proposed adding a "G" (gravid) to each class in a similar way to adding an "E" to indicate that the patient is pregnant. With these simple markings, inconsistencies have been reduced and communication between evaluators has improved.¹⁸

Caprini scale

Caprini et al.¹⁹ introduced in 2001 a stratification scale to prevent the risk of thromboembolic disease in non-surgical and surgical patients. The scale includes situations that may occur

for the open population, in high-risk groups and during pregnancy such as transfusions, bed rest for more than 72 hours, surgery time for more than 2 hours, pregnancy or childbirth in the previous month, death fetus, recurrent miscarriage, prematurity due to preeclampsia, fetus with intrauterine growth restriction, endoscopic surgery longer than 45 minutes, central venous access with a catheter, previous thromboembolic disease or pulmonary embolism, and a history of cerebrovascular event. A total risk factor score is calculated and patients are classified into 5 risk levels; "very low risk" (0-2 points), "low risk" (3-4 points), "moderate risk" (5-6 points), "high risk" (7-8 points) and "very high risk" (>8 points).

Detsky index

Detsky et al.²⁰ described in 1986 a multifactorial cardiac risk index to evaluate patients undergoing non-cardiac surgery. The index is a modified version of the index previously generated by Goldman et al.¹⁰ Includes coronary parameters supported by the recommendations of the Canadian Cardiovascular Society, data on the heart pump, aortic valve, atrial and ventricular arrhythmias, urea nitrogen, creatinine, potassium, bicarbonate and arterial blood gas values, chronic liver disease, immobility prolonged non-cardiac cause, age greater than 70 years and urgent surgery. The total points awarded serve to identify the patient in one of the pre-established categories: class I from 0 to 15 points, class II from 20 to 30 points and class III with more than 30 points. The Detsky index does not specifically include the condition of the pregnant patient.

Wells scale

The Wells Index was introduced in 1997²¹ to estimate the probability of suffering from deep vein thrombosis. It awards points (1, 1.5, and 3) to each of seven preset parameters related to clinical deep vein thrombosis, pulmonary thromboembolism, exploratory findings, cancer, and hemoptysis. The probability is low when the score is <2, intermediate probability from 2 to 6, and high probability when it is >6. The index rules out disease when the estimated risk is low and is most useful for estimating the risk of proximal vein thrombosis.

Geneva scale (Geneva Score)

The Geneva Score is a clinical probability index used to determine the pretest probability of pulmonary thromboembolism based on the evaluation of a series of patient risk factors and some clinical findings.²² It has the same usefulness as the Wells scale and depends less on the knowledge of the doctor

applying the prediction rule. The Geneva scale has been subsequently revised and simplified, so that the latest version seems to have the same diagnostic utility as the original version.²³ It uses eight variables to classify the probability of pulmonary thromboembolism into three categories: low probability (0 to 3 points), intermediate probability (4 to 10 points), and high probability (≥ 11 points).

ANESTHESIA DRUGS IN PREGNANCY

During pregnancy, all medications must be checked against the drug classification system issued by the Food and Drug Administration (FDA) of the United States of America in 2014:²⁴ Category A: controlled studies have shown no risk, Category B: no evidence of human fetal risk, Category C: risk cannot be ruled out, Category D: positive evidence of human fetal risk exists, Category X: contraindicated in the pregnancy.

In general, no anesthetic drugs or drugs commonly used in anesthesia are listed as teratogens in humans, but they have been associated with maternal effects that impair fetal well-being or with direct in utero adverse effects that result in spontaneous abortion, preterm delivery, and death.^{8,9} **Table 4** shows the fetal risk of drugs administered in anesthesia and surgery during pregnancy.

Conclusion

The preoperative assessment in the pregnant patient belongs to the face-to-face clinical territory. It is based on a directed history, exploratory findings, basic preoperative laboratory studies, an electrocardiogram, a chest x-ray, and fetal evaluation by the obstetrician. Special exams are restricted, they are only performed in special cases. The selection of the scales to issue the preoperative risk must be individualized in each case applying broad clinical criteria, always considering the gestational changes, the current problem, the possible complications and the comment that the anesthetic-obstetric team expects to follow the recommendations and start a procedure.

Conflicts of interests

None declared by the authors.

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