ANTEPARTUM FETAL SURVEILLANCE

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1. INTRODUCTION

The aim of antepartum fetal assessment is to identify those fetuses with chronic intrauterine hypoxia in order to plan strategies aimed at avoiding adverse outcomes and reducing the risk of stillbirth. There is scarce evidence available since there are no conclusive randomized trials in this regard. Because of the absence of conclusive evidence, recommendations regarding antepartum fetal surveillance are limited. In addition, the strategies that we have are not capable of making a prediction of acute hypoxemic events.

Thus, the decision to initiate antenatal fetal testing should be determined by the clinical situation as well as the epidemiological, maternal and fetal risk factors. Patients with a high risk for adverse perinatal outcome can present a perinatal mortality rate up to 10 times higher than those without risk factors.

At present, there are different tests available for the control of antepartum fetal surveillance: fetal movement counting, non-stress test (NST), stress test (Pose Test), vibroacoustic stimulation, and the use of ultrasound for evaluation of: amniotic fluid (AF), biophysical profile (BPP) and estimated fetal weight (EFW). The Doppler study should not be used as a screening tool of fetal well-being, except in cases of placental pathology.

In clinical practice, we can find three different situations:

- Antepartum fetal surveillance in outpatient clinics
- Antepartum fetal surveillance in the emergency room
- Antepartum fetal surveillance in hospitalization

2. INDICATIONS FOR ANTEPARTUM TESTING

2.1 ANTEPARTUM FETAL SURVEILLANCE IN OUTPATIENT CLINICS

2.1.1 FETAL MOVEMENT COUNTING

The only recommended prenatal surveillance technique for all pregnant women, with or without risk factors, is fetal movement counting. For this reason, all pregnant women will be given an information sheet on fetal movements, together with the morphological ultrasound report. It can be summarized as follows:

- Pregnant women without risk factors (RF): they should be aware of the perception of fetal movements and be asked to perform a fetal movement count if they perceive a decrease in movements.

- Pregnant women with risk factors (Table 1): they should carry out a daily count of fetal movements beginning at 26-32 weeks of gestation (W).

Those pregnant women who do not perceive ten movements within an interval of two hours will require further antenatal testing of fetal well-being.

2.1.2 NONSTRESS TEST AND ULTRASOUND

In full-term gestations, we add to the control of fetal movements other measures to control fetal well-being according to risk factors (Table 1):

- PREGNANCIES WITHOUT RISK FACTORS

Despite the widespread use of the NST, there is no evidence that it can reduce perinatal morbidity or mortality in pregnancies without risk factors. Consequently, in pregnant women without risk factors, an NST will be routinely added to the control of fetal movements at 40 weeks of gestation.

In low-risk patients who prefer expectant management between 41-42 weeks, monitoring of fetal well-being by NST every 48-72 hours will be added, as well as an ultrasound to determine amniotic fluid volume (single deepest pocket), a middle cerebral artery (MCA) Doppler, and estimation of fetal weight and determination of centile (if no EFWavailable in the last 14 days).

- PREGNANCIES WITH RISK FACTORS

In those pregnant women with RF (Table 1), antenatal well-being controls will begin according to specific condition (see corresponding protocol). In the absence of a specific protocol, controls will begin weekly with NST between 38-39 weeks.

In patients with maternal age ≥ 40 years, BMI ≥ 30 kg/m^2, or with a diagnosis of intrahepatic cholestasis (in which our recommendation is termination of pregnancy around 40w) who prefer management beyond 40 weeks, add antenatal fetal testing every 48-72h by NST, ultrasound (AF volume (single deepest pocket) and MCA Doppler) and EFW (if it isn't available in the last 14 days).

2.2 ANTEPARTUM FETAL SURVEILLANCE IN THE EMERGENCY ROOM

Given the lack of documented criteria to evaluate fetal well-being in preterm pregnancies, we will perform:

- An NST for those pregnant women ≥ 24 weeks who attend for an obstetric reason or in which fetal well-being may be compromised (sensation of uterine contractions, decreased fetal movements, high blood pressure, haemorrhage, fever, trauma, etc.), or in which the reason for consultation may imply the presence of subclinical uterine activity (for example, acute pyelonephritis, gastroenteritis, etc.).
- In those of ≥ 24 weeks who attend for non-obstetric reasons (for example: vulvovaginitis, sciatica, toothache, otalgia, etc.), fetal well-being can be assessed either by auscultation/observation of fetal heart rate, ultrasound observation of fetal movements and amniotic fluid volume, or alternatively by NST.
- If there is no other obstetric indication, in patients < 24 weeks, cardiac activity will be checked by auscultation (or ultrasound if ultrasound is to be performed for any other reason).

In full-term pregnancies, we will perform NST at 40 weeks in those pregnant women who do not present risk factors; from 38-39 weeks if they present risk factors; or according to specific condition (see corresponding protocol).

2.3 ANTEPARTUM FETAL SURVEILLANCE IN HOSPITALIZATION

Pregnant women ≥ 24 weeks who require hospitalization:

- Fetal surveillance testing will be carried out depending on the cause of admission and risk factors.
- If no specific protocol is available, daily NST will be performed during the first 2-3 days of hospitalization. If it is normal and there is no maternal or fetal clinical change, it will be performed weekly.
- NST will be carried out prior to discharge.

If there is no other obstetric indication, for pregnant women < 24 weeks, fetal cardiac activity will be checked weekly and prior to discharge.

3. INTERPRETATION OF NST

The interpretation of the NST should take into account the gestational age because, between 24-28 weeks, up to 50% of the fetuses do not present accelerations. In contrast, between 28-32 weeks only 15% of the records are non-reactive. The NST classification in term gestations is detailed in Table 2. In preterm gestations, interpretation should be more permissive, as the criteria are not always met (for example, prolonged periods of tachycardia with good frequency and accelerations, absence of accelerations with good variability, etc.).

In cases where the computerized cardiotocography (cCTG) is available, an automated reading can be performed similar to that performed by an electrocardiogram.

A) If the cCTG is not available:

If the NST is **NORMAL-REACTIVE**, it is not necessary to perform other fetal well-being tests. The patient should follow the usual care.

If, after 20 minutes, the CTG cannot be classified as normal, monitoring will continue for another 20 minutes. The reduction in reactivity and variability, as well as the decreased fetal movements, may be justified by the non-REM phase of fetal sleep (average duration of 20 minutes). If, after this period, the CTG is normal, the patient will be discharged and the usual care will be scheduled.

B) If cCTG is available:

The criteria are met, on average, after 12 minutes. At 20 minutes, 75% of the records meet the criteria. At 40 minutes, 90%. Only 2.5% do not meet the criteria at 60 minutes. This is when the different algorithms require an evaluation by a physician or midwife.

Therefore, if a computerized CTG is available:

- As soon as the criteria are met, continue with the scheduled appointments with the referring physician/midwife.
- If the criteria described are not met, it will be prolonged 40 minutes. If, after 40 minutes, the criteria are not met, we will proceed in the same way as the normal CTG – non-reactive.

If, after 40 minutes, the NST is **NORMAL-NON REACTIVE,** the patient's vital signs will be taken and glycemia will be determined to rule out possible triggering causes (e.g. fever, tachycardia, hypotension, hypoglycaemia, uterine contractions, etc.). In addition, postural changes will be made. The ingestion or administration of glucose to the pregnant woman and the external manipulation of the fetus have shown no evidence of being helpful.

If, despite these measures, the same pattern persists, an ultrasound will be performed to assess the biophysical profile (BPP). The BPP is detailed in Table 3.

If the NST is **ABNORMAL,** the patient will be referred to the emergency room and an evaluation of the situation will be carried out as soon as possible. Vital signs and glycemia will be determined to exclude possible triggering causes (for example fever, tachycardia, hypotension, hypoglycaemia, uterine contractions, etc.) and it will be assessed whether there is a cause that implies intervention. Delivery decision will take into account the clinical situation, the potential correction of triggering factors, NST alterations and gestational age.

If immediate delivery is not considered, decisions will be based on the result of the BPP. According to the BPP (Figure 1):

- BPP 8/10 and the patient DOES NOT have risk factors, will be scheduled for usual care control. If she presents any risk factor, an appointment will be made in 48-72 hours to repeat BPP.
- BPP ≥ 6/10 and normal amniotic fluid: repeat BPP in 24h.
- BPP ≥ 6/10 and abnormal amniotic fluid: delivery if ≥ 37 weeks. If < 37 weeks, evaluate the relevance of lung maturation and follow up every 6 hours with BPP.
- BPP ≤ 4/10: consider delivery immediately.

SUPPLEMENTARY DATA
TABLE 1: RISK FACTORS FOR ADVERSE PERINATAL OUTCOME

MATERNAL
• Diabetes • Others endocrine disorders: thyroid disorder • Chronic hypertension • Maternal heart disease • Antiphospholipid syndrome • Thrombophilia • Infectious disease • Renal disease
EPIDEMIOLOGICAL RISK FACTORS
• Maternal age (< 18 years or > 38 years) • BMI > 30 kg/m^2 • Substance use: tobacco, alcohol • Black race
OBSTETRICS COMPLICATIONS
• History of other adverse pregnancy outcomes • Uncontrolled pregnancy • History of abdominal trauma • Late term • Growth restriction or Gestational hypertension • Decreased fetal movement • Premature rupture of membranes • Multiple gestation • Rhesus immunisation • Alteration of amniotic fluid • Fetal anomalies, aneuploidy or fetal infections. • Placental factor (vasa previa, placental haematoma) • Threatened preterm labour • Cholestasis

Parameter		NORMAL – REACTIVE	NORMAL – NON-REACTIVE	ABNORMAL
Baseline		110-160 bpm	• 100-110 bpm • > 160 bpm < 30 min	• < 100 bpm • > 160 bpm for > 30 min
Variability		• > 5 and < 25 • 5 ≤ or ≥ 25 < 15 min	5≤ or ≥ 25 for 15-30 min	• 5 ≤ bpm for > 30 min • ≥ 25 bpm for > 30 min • Sinusoidal
Decelerations	**No contractions**	None	Spontaneous occasional	• Spontaneous repetitive (> 1/10 min for 30 min) • Prolonged > 5 min
	Contractions	• None • Early • Variable occasional (< 30% of the contractions < 30 sec)	• Variable recurrent (30-50% of the contractions) or for 30-60 sec • Prolonged ≥2 min but < 5 min	• Variable repetitive > 50% of the contractions or for > 60 sec • Late • Prolonged > 5 min
Accelerations	**< 32w**	≥ 2 (10 bpm and 10 sec) for 40 min	<2 (10 bpm and 10 sec) for 40-90 min	<2 (10 bpm and 10 sec) for >90 min
	≥ 32w	≥ 2 (15 bpm and 105 sec) for 40 min	<2 (15 bpm and 15 sec) for 40-90 min	-

bpm: beats per minute; min: minute; sec: second; w: weeks

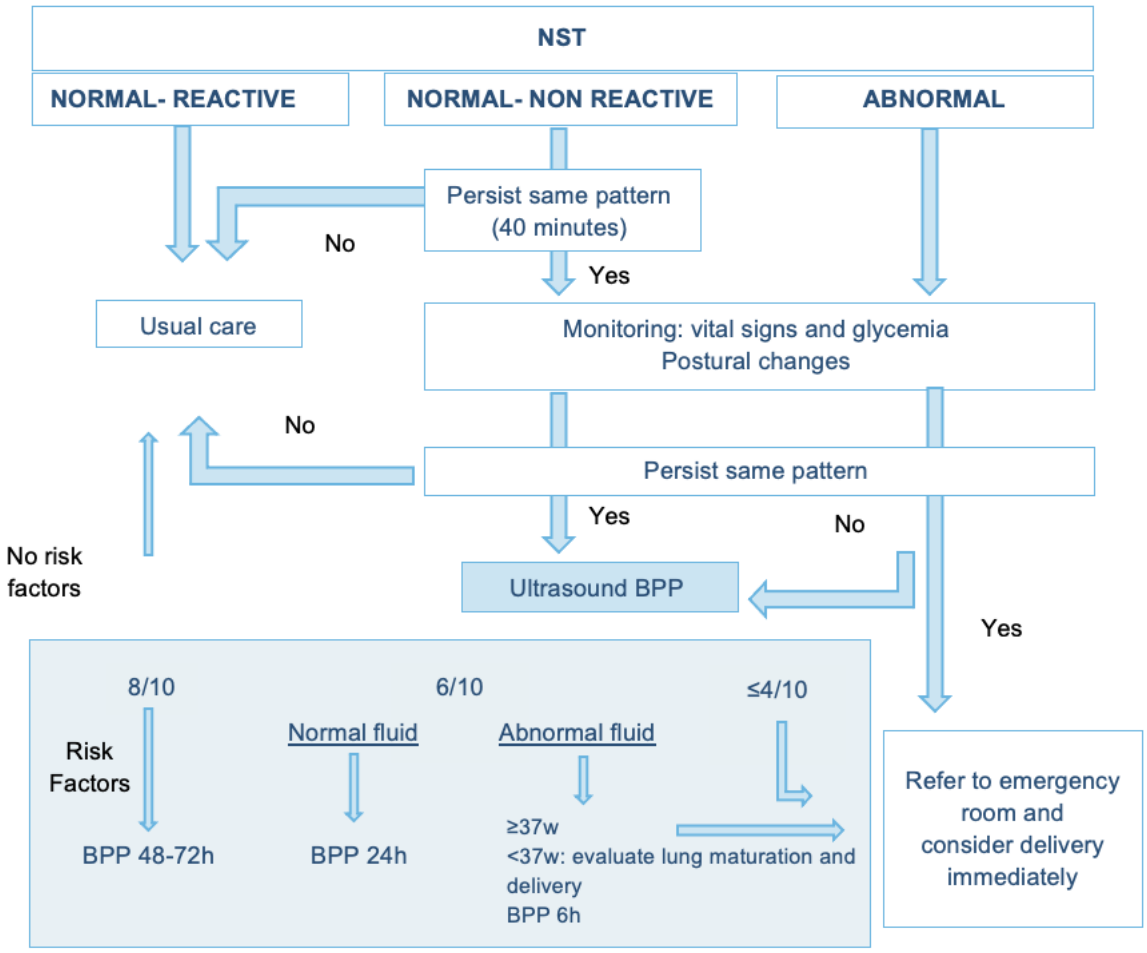
TABLE 2: CTG CLASSIFICATION AT TERM FETUSES

TABLE 3: BIOPHYSICAL PROFILE (BPP)

The BPP combines the NST with ultrasound fetal assessment by assigning points to the following five parameters for 30 minutes. Each of these parameters scored 0 (if absent) or 2 (if present) and were added together to obtain a maximum score of 10.

- Breathing movements: ≥ 1 episode continuing more than 20 seconds.
- Fetal movements: ≥ 2 movements of the limbs or trunk.
- Fetal tone: ≥ 1 episode of extension-flexion of the trunk or limbs or opening and closing of the hand.
- Amniotic fluid: at least one cord and limb-free fluid pocket of ≥ 2 cm.
- NST: normal.

FIGURE 1: BIOPHYSICAL PROFILE ALGORITHM



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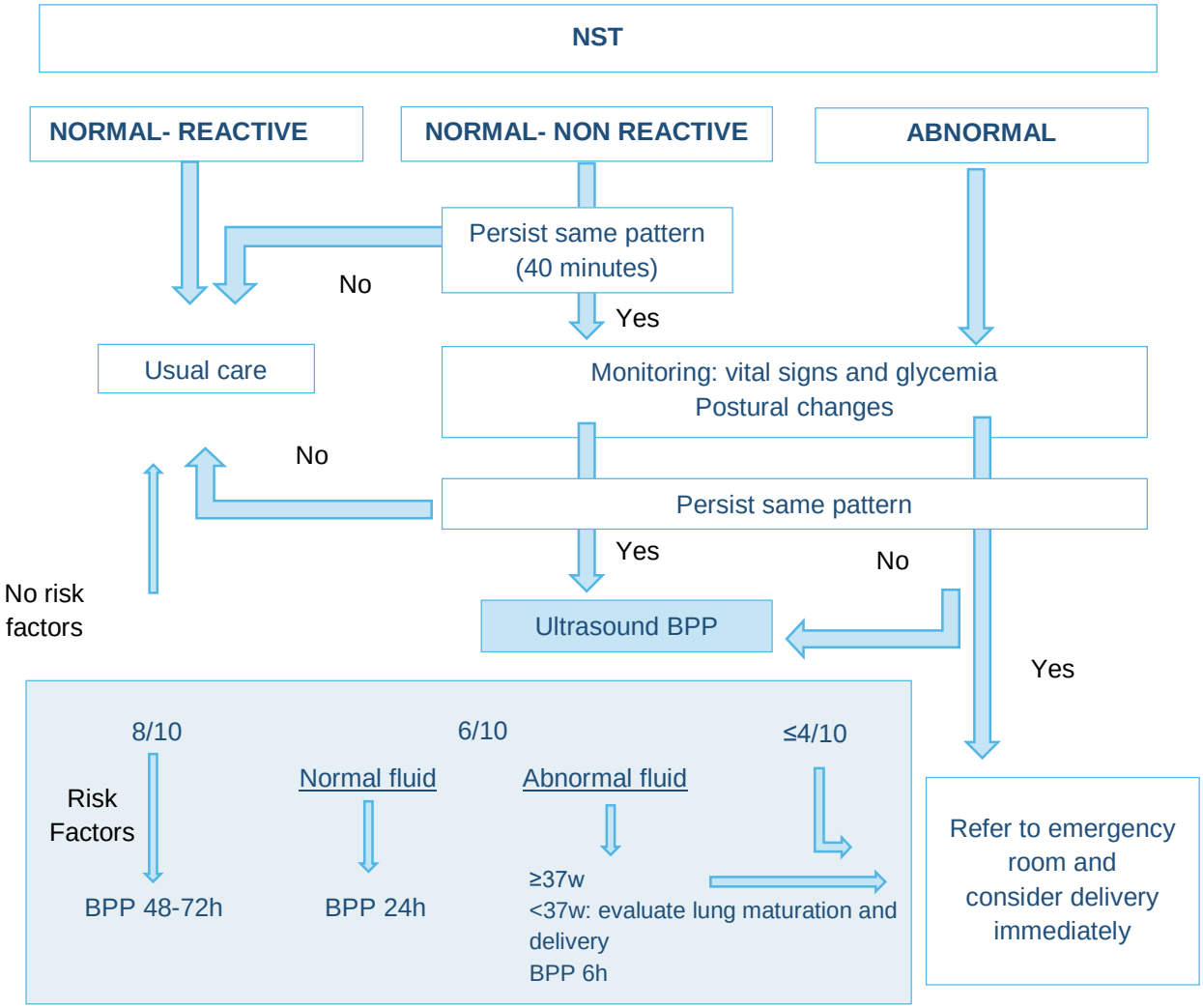
NST
NORMAL- REACTIVE
NORMAL- NON REACTIVE
ABNORMAL
Persist same pattern
(40 minutes)
No
Yes
Usual care
Monitoring: vital signs and glycemia
Postural changes
No
Persist same pattern
Yes
No
No risk
factors
Ultrasound BPP
Yes
8/10
6/10
≤4/10
Risk
Factors
Normal fluid
Abnormal fluid
BPP 48-72h
BPP 24h
≥37w
<37w: evaluate lung maturation and
delivery
BPP 6h
Refer to emergency
room and
consider delivery
immediately