Follow-up guide for the new born with risk of neurological sequels

1. Introduction

Part of the new born patients of the intensive care units are having a risk of neurological sequels due to immaturity, certain diseases or aggressive treatments. These children requires periodic follow-up in a special program that allows early detection of neurological problems (1).

In order to obtain maxim possible recovery of these patients, the neurological diagnosis must be establish as early as possible by using screening tests, a cost-efficient exam with known specificity and predictive value that is able to identify in a population the individuals at risk to develop a certain disease (2).

In the following paper we will present, in the first section, the objectives of new born children with risk follow-up program, and then the organizing principles. A special chapter will be devoted to neurological and behavior development, hearing screening and ophthalmologic follow-up.

2. Objectives of a follow-up program for new born children with risk

Long term new born children with risk follow-up have the following objectives: (1) medical act efficiency and quality control in the intensive care unit for new born children; provision of multiple diagnosis and treatment services for this special children category, staff training, research activities.

Medical services quality control in the intensive care unit for new born children may embrace several aspects. First, using standardized techniques, different departments performance can be appraised regarding mortality and different types of morbidity. Secondly, in the same services frame, the intensive care units performances evolution can be evaluated in a certain time frame, this representing a feedback method. Also, but not lastly, different types of interventions’ efficiency can be evaluated.

A follow-up program for new born children with risk allows for this children assurance of specialty services, adequate diagnosis and treatment. The specific objective of the follow-up are: early detection of neurological and behavior anomalies, early treatment realized by cooperation of several types of specialties, recognition of some transient anomalies, and, very important, communication with parents and provision of medical, psychological and social support in order to assure optimal development of the premature children.

In the universities, in the follow-up programs for new born children with risk the young specialists training is realized in different areas: neonatology, pediatric neurology, occupational therapy, research activities.

Also, in the universities, the follow-up programs for new born children with risk is a research instrument, both regarding the development of premature children (descriptive studies) and for the evaluation of different techniques’ results. Aylward, in 1989, said that a lot was learned during the years in the follow-up studies, but yet a lot is still to be researched in this area of medicine. Indeed, in USA or in Europe are going on or had been going on numerous follow-up studies for the new born children with risk and important resources are dedicated to these programs.

The program is an activity involving several disciplines: neonatology (for the inclusion in a study and follow-up), pediatric neurology (for diagnosis purposes), ophthalmology, NET, occupational therapy and physiotherapy.
3. Follow-up inclusion criteria

The following children categories discharged from the intensive care units will be included in a follow-up program for new born children with risk (table 1, table 2):

A/ Premature children with less than 1500 g at birth

As a consequence of the anatomical and physiological particularities, the premature children have a higher risk of cerebral paralysis (CP) than in the general population. In USA Pharoah & al found in 1990 an incidence of the CP of 6-10% in premature children with less than 1500 g at birth (VLBW) (3); in the same population, in a study published in 1990, Burguet found in France an incidence of CP of 13 % (4). Also, they have a higher risk of speaking anomalies and minor neurological and behavior sequels. (5).

From the ophthalmologic point of view this category of children has a high risk of retinopathy and this risk is increasing with the decrease of the gestational age. Also, in the group at risk for retinopathy are included the premature children with less than 32 weeks of gestation.

Also, this category of children has a high risk of deaf, especially in association with long treatment with aminoglicozides (6).

B/ New born children with moderate and severe peri-natal hypoxia (stages Sarnat II and III)

The new born children with severe forms of hypoxic-ischemic encephalopathy (Sarnat II; III) have a risk of developing in the future different forms of mental retardation and associated movement deficits associated with different types of lesions.

10-30% of the new born children that had selective neuronal necrosis presents convulsions and epilepsy. (7) In case of neuronal parasagital necrosis, most of the children have intellectual deficits. (7) In 25% of the infarction of the sylvian artery survivors appears the spastic hemi paresis, and 10% of these children have convulsions (7).

Also, these children have a risk of hearing (6, 7) and visual abnormalities through central lesions. (7).

C/ New born children with high bilirubin requiring transfusion with blood replacement

The free bilirubin passes the blood-brain barrier when its’ blood concentration is above a certain level. By fixing at the level of certain regions of the central nervous system (basal nucleus), bilirubin produces neurological lesions and a clinic syndrome manifest both in neo-natal period and after that as neurological sequels. These are: hypo tone and late motor acquisitions, extra-pyramid alterations, abnormalities of the eyes, intellectual deficits (8).

Another consequence of bilirubin is hearing impairments that can go as far as severe forms up to late speaking ability (6). In case of high bilirubin that is above the needed levels for blood replacement transfusion it appears that the cause of the hearing lesion is at the level of the cerebral trunk’s neurons, especially the one from the cochlear nucleus and at the level of hearing nerve (VIII) (7). According to Volpe, 63% of the children with hiperbilirubinemic encephalopathy presents different degrees of hearing deficiency (8).
D/ New born children with mechanical ventilation

After several studies it was observed that the time of mechanical ventilation is proportional with the incidence and severity of the neurological sequels (9). A study published in 1992 underlines the importance of a mechanical ventilation period for the installation of abnormal BINS scores after that (9), the children being less active, adaptable to the environment and tolerant to external environment stimulus. This is why the follow-up of all the patients ventilated mechanically in the intensive care unit for newborn children is recommended.

The new born children presenting pulmonary hypertension mechanically ventilated have the risk to develop hypopcapnie that increases the risk for hearing lesions (1-). This is why the hearing screening of the pulmonary hypertension mechanically ventilated patients is recommended.

D/ New born children that presented convulsions

The convulsions represent high intensity activity of some groups of neurons. They can lead to neurological sequels by directly affecting the cerebral metabolism. They can also be in that period the manifestation of infectious, metabolic diseases of the nervous system. About 25-35% of the new born children that presented convulsions have neurological sequels (mental retardation, convulsions, motor deficit) (11).

All these lead to the need to follow-up the new born children with convulsions.

E/ New born children with infections of the central nervous system

The central nervous system infections lead to both direct neurological lesions due to pathogen agents (cerebral abscess, neuronal destruction in case of chronic intrauterine infections) and destructions appeared as a consequence of complications (secondary hydrocephaly, ventriculitis). In the case of new born children with meningitis with B streptococcus the sequels incidence is of 21% and in case of cerebral abscess it is 75% (12). In case of chronic intrauterine infections the incidence depends of the etiology pathogen agent.

Because the deficits at the level of various areas appear in time, the follow-up of these patients is also needed.

F/ New born children with abnormalities at the screening neurological examination

The system based on risk factors manages to select from the new born children population the ones at risk of developing neurological sequels in the next short term period. It is possible that some of the new born children to escape this selection system because even if they will develop in time neurological sequels that are not part of a group at risk. (13).

This is why it is recommended that all the discharged new born children to have a screening test (proposed by Amiel Tison). The examination consists of 10 tests. It can be integrated in the clinical general examination at discharge and last maximum 5 minutes. The new born children that are positive at this test will be included in the follow-up group. (13).

F/ Other categories
The children with ear abnormalities will be tested when discharged from the hospital.

4. The organization of a follow-up program

A/ Space
The children follow-up will be done at the level of the IIIrd degree center from where they were discharged. There will exist a dedicated space for this activity (Follow-up office).
Both ophthalmologic and hearing follow-up can be done at the level of the intensive care units for new born children.

B/ Staffing
The follow-up office activity will be supervised by a program coordinating physician that has the following duties:
- schedules the patients visits
- diagnosis supervision
- assures and supervises staff training
- assures the communication with specialty clinics

The staff that does the follow-up will consist of 2-3 physicians that are trained in neurological and behavior tests.
The hearing test will be done by specially trained physicians (2 for each center). They will report the results to the coordinating physician.
The ophthalmology control will be done by the ophthalmologist that will be in connection with the specialty clinic.

C/ Relations with other clinics
The follow-up office will develop connections (based on mutual understandings or contract) with:
- a pediatric neurology clinic
- a MNT clinic
- an ophthalmology clinic

that will take over the cases discovered by the program.
It is recommended to exists also the possibility to have general pediatric consultations in order to orient the patients that requires special care to these units.

5. The follow-up program unfolding

A/ The neurological tests (Diagram 1)
When discharged from the hospital all the new born children will receive screen test Amiel Tison (13). In case of abnormalities the new born child will be included in the follow-up group.
For the new born children that are part of the group exposed to the risk (table 1) the complete neurological examination proposed by Amiel Tison will be performed at discharge from the hospital. For the premature children the examination will be performed at the gestation age of 40 weeks. (13). In case of abnormalities the new born child will be
send to the neurology clinic. The follow-up will continue in this case also, in the program in order to establish which the evolution under the treatment is. In case of a normal result the visits program will continue.

The visits will be done at 4, 8, 12, 15, 18, 24 months of corrected age (14). An examination Bayley Infant Neurodevelopmental Screener (BINS)(14) will be performed. In case of a normal result the follow-up will be continues till 24 months. In case of an abnormal Medium risk result the child will be retested after one month. In case the result is still Medium Risk or High Risk the patients will be send to the neurology clinic. In case of abnormal BINS of High Risk the patient will be send to the neurology clinic (14).

The visits will be done at 4, 8, 12, 15, 18, 24 months of corrected age in order to see the evolution under the treatment (13, 14, 15).

The corrected age is calculated by subtracting from the actual age of the child the difference between the child’s gestational age and 40 weeks.

Also, in case of examination at the above mentioned intervals the following will be evaluated: the cranium perimeter and the weight diagram. The weight index will be calculated. In case the increase in the cranium perimeter is slow the child will be send to the pediatrics neurology department for further investigations. (13, 15).

At the age of 18 month the CHAT test will be performed in order to detect autism. The positive patients will be oriented to pediatric psychiatry clinics. (13).

B/ The test of hearing (Diagram 2)

The test of hearing will be done with AABR method (automated auditory evoked potentials), in case of the new born children at risk (table 2) (16).

The first examination will be done at discharge from the hospital. In case the result is pass, the patients is retested in 6 month. In case of a refer result the patient will be retested in 1 month. If at retest the result is pass, the examination will be repeated after 6 months. In case of a refer result the patient will be send to a specialty clinic. For the test at 6 months a pass result excludes the possibility of hearing problems. In case of a refer result the patient will be send to a specialty clinic (16).

C/ The ophthalmologic test

The first examination is done at the age after birth of 3-4 weeks, according to the general status of the child. The examination is repeated weekly till the discharge or till the age of 3 months. When the retinopathy reaches the LASER indication:

1. retinopathy stage III +
2. retinopathy stage II + to which the fibro-vascular peak is over 8 hours with cumulated or separated arches

The examinations will be done every other day till the end of the treatment.

It is recommended that the LASER treatment to be performed at the level of maternity (tertiary center).

The following controls will be done after 24 hours after the treatment and then every other 2 days waiting for the retinopathy regression signs that should appear after 4-5 days.

The controls are done every 3 months till the age of 1 year. After 1 year another control is done at 4 years and the next one at 6 years (age for school).
6. Program efficiency monitoring and the guide implementation and revision method

In order to follow the program efficiency the following indicators will be watched (17):

- the percentage of children followed up during the entire program duration (24 months). In order a program to be efficient the percentage of children followed up should be at least 80%.
- the number of cases identified with different pathologies during the program. The time when the abnormally is detected and its type.
- The efficiency of the specialty intervention: number of cases send to different centers (neurology, MNT, ophthalmology), number of cases took in evidence by other centers, the interval between the moment of sending and taking in evidence, percentage of solved cases, way of solving the cases.
- The cost per identified case (separately by neurology, MNT, ophthalmology)

After publication the guide will be discussed with the respective departments staff. The staff will be trained.
- After 1 year the guide will be reviewed.
- After that the revisions will be done every 3 years.
Bibliography:


10. Cloherhy


