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Newborn Screening Programme *for* Inborn Errors of Metabolism (IEM)

醫院管理局
HOSPITAL AUTHORITY

Newborn Screening for IEM at a Glance

1 **Antenatal Visit**

Antenatal health education related to Newborn Screening Programme for IEM is provided by healthcare professionals.

2 **Consent**

With parent's written consent after delivery, majority of babies will receive heel pricking procedure for blood specimen collection at 24-72 hours after birth.

3

Collection of blood specimen on a filter paper card.

4 **Laboratory**

Laboratory analysis

5 **Screening results**

Screening results of IEM are usually available within 7 working days.

6 **Report**

Normal results: Parents will not receive notification.

For abnormal or uncertain results: Parents will be informed early by phone. Babies will be referred to paediatricians for further evaluation.

What is Newborn Screening?

Through the provision of screening test to newborn babies, it is intended to achieve early diagnosis of serious yet treatable disorders which may not have obvious symptoms at the early stage, so as to reduce morbidity and mortality.

The Newborn Screening (NBS) for IEM was first introduced in 2015 in Hong Kong through a pilot scheme launched with the Hospital Authority. Nowadays, NBS for IEM and Severe Combined Immune Deficiency (SCID) have become regular services provided to all babies born at the eight public hospitals with Obstetrics service.

Starting from October 2023, the Hospital Authority will launch the Pilot NBS for Spinal Muscular Atrophy.

What is IEM?

Metabolism takes place at all times inside our body in order to keep us alive and to enable our diverse functions. Examples of metabolism include how food, after digestion and absorption, is converted into energy and various body tissues; how aged or damaged tissues are renewed and how the daily metabolic waste is disposed.

IEM occur because of inherent deficiency in certain enzyme or co-factor, which impairs normal metabolism. Accumulation of toxic substances or deficiency of essential metabolites may damage organs such as the brain, the liver and the kidneys, leading to serious consequences of physical and mental disabilities.

Why is IEM Newborn Screening Important?

IEM is a diverse group of genetic disorders. Although any one disorder is very rare, the collective incidence of the whole group is not as rare. The estimated incidence of IEM is about 1 in 4000 newborns in Hong Kong. As most IEM conditions are recessively inherited, family history is often absent. Therefore, even if the parents and family members are all healthy, IEM can occur in any newborn.

Owing to the lack of obvious signs and symptoms at the early stage, IEM conditions are usually not noticeable to parents or even medical professionals. Yet the appearance of obvious signs and symptoms may indicate the presence of organ damage or even at risk of death. The latest medical technologies enable early detection, diagnosis and treatment which may avoid or ameliorate serious consequences caused by IEM.

What is the Scope of this Screening Programme?

Given the diverse nature of IEM, not all metabolic diseases are included in the programme. The scope of screening is determined by considering the prevalence and seriousness of the diseases, the availability of reliable testing methods as well as the availability and effectiveness of the treatments. After making reference to international practices and opinions of local experts, this newborn screening programme covers 26 IEM conditions (please refer to the Appendix for details) under the following three major categories and the category of other IEM:

- **Amino Acid Disorders**
- **Organic Acid Disorders**
- **Fatty Acid Oxidation Disorders**
- **Other IEM**

Is My Baby Eligible for this Screening Programme?

All babies born at the eight Public Hospitals with Obstetrics are eligible for the screening programme, as long as a written consent is signed by a parent. Participation is voluntary and free of charge.

What is the Screening Process like?

The screening process of IEM is conducted along with that for SCID and SMA, including health education, blood sample collection, laboratory testing, confirmation of screen-positive (abnormal or uncertain) cases and referral for follow-up care.

Health education

The obstetrics departments of the Public Hospitals will provide antenatal and postnatal health education to expectant mothers who have delivery booking there and post-delivery mothers. The healthcare professionals will explain the details of the screening programme to them.

Blood specimen collection and delivery

With the written consent from parents, babies who reach 24-72 hours after birth and preferably have been milk-fed for at least 24 hours will have heel pricking with a lancet for blood specimen collection. A small volume of blood will be dotted on a filter paper card. If you consent to newborn screening for IEM, SCID and/or SMA, the blood specimen on the filter paper card would be used to screen for all the above-mentioned conditions. Newborn babies under the following conditions require additional blood specimens for testing* :

1. prematurity (less than 34 weeks of gestation), or
2. birth weight less than 2kg, or
3. being admitted into Neonatal Intensive Care Unit (NICU).

Schedule of additional blood specimen collection		
First specimen	**Second specimen**	**Remarks**
To be collected at 24 to 72 hours after birth.	To be collected at discharge or on day 28 after birth, whichever comes first.	If blood transfusion is required before the first specimen is collected, one more *pre-transfusion sample* would be collected.

Heel pricking is a safe blood collection method specific for newborn babies. The risks are small, including pain and possible bruising at the puncture site. Few babies have an infection as a result of the heel prick. Parents who find abnormal redness and swelling at the puncture site on their babies should inform the medical staff for management.

**All blood samples are to be sent to the laboratory under the Hospital Authority for testing.*

Screening results and follow-up

Screening Results		Follow-up Action
Normal	**Risk** of suffering from the screened metabolic diseases is very **low**.	Parents will not receive any notification.
Abnormal	**Risk** of suffering from the screened metabolic disease is **high**.	Hospital staff will notify parents by telephone **within 7 working days**. Babies will be referred to paediatricians for further diagnostic testing and management.
Uncertain	About 1% of the screened specimens will have uncertain results.	

Diagnostic testing

For **abnormal** or **uncertain** screening results, further evaluation and diagnostic testing is required. Diagnostic tests generally include blood, urine, and/or genetic testing, depending on which specific IEM condition is implicated by the screening results.

Treatment arrangement

Depending on the health condition of the babies, admission into the hospital or consultation at the specialist outpatient clinic will be arranged. These services will be charged as admission or attendance at the specialist outpatient clinic under the Hospital Authority accordingly.

How Accurate is the Screening Test?

Although the accuracy of IEM screening is generally high, it is not 100% accurate. Affected patients can escape detection by the screening (i.e. false negative). Hence, a normal screening result only suggests the chance of having IEM conditions under the scope of this screening programme is low but cannot be taken that these conditions are excluded. On the contrary, some normal babies may be mistakenly identified as potential patients (i.e. false positive). An abnormal or uncertain result does not necessarily mean the baby is affected; it only indicates that further follow-up assessment by paediatricians is necessary. The false positive and false negative rates vary among different IEM conditions.

It is also possible to detect incidental findings that are out of the scope of this screening programme. These incidental findings may or may not have clinical impact on your baby. Further follow-up assessment by specialist will be arranged.

Enquiries

For general queries, please call:

5741 4280 (Clinical Genetics Service Unit, Hospital Authority)

For further enquiries about this Newborn Screening Programme for IEM, please approach your healthcare professionals when attending antenatal visits.

Appendix

Scope of the Newborn Screening for IEM

(Total 26 IEM conditions)

Disorders of Organic Acids (8 conditions)
Beta-ketothiolase deficiency
Glutaric acidaemia type I
Isovaleric acidaemia
Methylmalonic acidaemia (Methylmalonyl-CoA mutase deficiency)
Methylmalonic acidaemia and homocystinaemia (Cobalamin C deficiency)
Multiple carboxylase deficiency
Propionic acidaemia
3-hydroxy-3-methylglutaryl-CoA lyase deficiency

Disorders of Amino Acids (9 conditions)
Argininaemia
Argininosuccinic acidaemia
Citrullinaemia type I
Citrullinaemia type II
Classic phenylketonuria
Homocystinuria
Maple syrup urine disease
Tyrosinaemia Type I
6-pyruvoyl-tetrahydropterin synthase deficiency

Disorders of Fatty Acid Oxidation (6 conditions)
Carnitine-acylcarnitine translocase deficiency
Carnitine palmitoyltransferase II deficiency
Carnitine uptake deficiency
Glutaric acidaemia type II
Medium-chain acyl-CoA dehydrogenase deficiency
Very long-chain acyl-CoA dehydrogenase deficiency

Other IEM conditions (3 conditions)
Biotinidase deficiency
Classic galactosaemia
Congenital adrenal hyperplasia