Newborn Screening Improving Children’s Health

By

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New Born Screening Improving Children’s Health

Introduction

- New born screening is an essential public health strategy
- Enable early detection & management of several congenital metabolic disorders
- Need good collaboration and responsibility in the system. Need dedicated Coordinator.
Newborn Screening Improving Children’s Health

Introduction
Row data of Congenital Hypothyroidism (CH) in Indonesia, (2017)
- Total newborn 5.000.000/year
- Total babies screened 85.000 babies/year
- % babies screened 1.7%/year
- Incidence of CH 1 : 3000
- Total Cases 1600 babies/year
- Total cases detected 28 babies/year
New Born Screening Improving Children’s Health

Introduction

- If left untreated: Mental retardation or death
- If early diagnosis and treatment: Result in normal growth and development of the affected individual. Treatment must be long life.
“Before” and “After” Screening
1.600 affected babies per year

- If not detected by Screening
  - ”disaster” for the family.
  - Need life support for whole life (around 65 years) by family and government.
  - Not productive (mental retardation = IQ about 80)
  - The cost of the patients are very high.

- If detected by Screening
  - The cost is much lower about $1/10$ compared to the cost if the patients are not detected by screening.
IAEA contribution (1999-2011)

IAEA (International Atomic Energy Agency) sponsored Newborn Screening for congenital hypothyroidism in East Asia states, including Indonesia.
Participants of IAEA Coordination Meeting for CH
The activities of IAEA

- Meeting with government to promote Newborn Screening in Indonesia.
- Moral support for starting Newborn Screening
- Technical guidance: workshops, symposia (every year for 10 years)
- Sponsor to get reagensia and a new instrument (Perkin Elmer)
The results of IAEA Contribution

• With the guidance of IAEA, Newborn Screening is starting in Bandung in 2000 and Jakarta in 2001 with government and IAEA support for reagensia & instrument.

• From 2001 – 2011 there are 57000 babies screened (6000 babies/year) in Jakarta and 18 cases found.

• Now (2017) there are 85.000 babies screened/year in Bandung and Jakarta that are funding by government.
Urgency

Congenital Hypothyroidism

- Percentage of new born screened in:
  - Indonesia 1.7%
  - China 54%
  - Philippines 50%
  - Viet Nam 24%

- Indonesia
  Total cases: 1600 babies/year
  Total cases detected 28 babies/year
How to Screen?
(Congenital Hypothyroidism)

• Preinstrumental phase
  - Sampling
    3th-5th day of life
    Heel Prick Method
    Guthrie filter paper
    Transport and storage management of filter paper

• Instrumental Phase
  - Chemiluminescence (Fluorescence) method
  - Formerly Radioimmunoassay (RIA) method
• Post Instrumental Phase
  - quick result
  - System for confirmation test
    repeat testing if: 18 – 22 μu/L
  - System for handling positive result
    (>22 μu/L) : Finding patient for consulting the pediatricians
Heel Prick Method
PROGRAM SKRINING HIPOTIROID KONGENITAL

Rumah Sakit : ________________________/No. Medrec ____________
Nama Ibu : ________________________ Nama Ayah : ________________________
Alamat : ________________________
Telepon / Hp : ________________________
Umur Kehamilan : ___
Prematur : ___ Ya ___ Tidak
Jenis Kelamin : ___ L ___ P
Berat : _________ gram
Lahir
\[
\begin{array}{ccc}
<table>
<thead>
<tr>
<th>Tgl</th>
<th>Bin</th>
<th>Thn</th>
</tr>
</thead>
</table>
\end{array}
\]
Spesimen
\[
\begin{array}{ccc}
|   |   |   |
\end{array}
\]
Transfusi Darah : ___ Ya ( Tgl. ___/___/___ )
Keterangan
\[
\begin{array}{ccc}
| Ibu makan obat anti tiroid | ___ Ya | ___ Tidak |
| Bayi dengan wejeh mongoloid | ___ Ya | ___ Tidak |
| Bayi sakit | ___ Ya | ___ Tidak |
\end{array}
\]
Dokter Pengirim :
Dokter Konsultan :
Fluoroskan Ascent
UK-Neqas Birmingham for TSH

<table>
<thead>
<tr>
<th>Spec. Pool</th>
<th>Pool description / Treatments / Additions</th>
<th>Analyte: Final TSH (mU/L WB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>284A 628</td>
<td>DBS stored frozen; freshly prepared at 280</td>
<td></td>
</tr>
<tr>
<td>284B 629</td>
<td>DBS stored frozen; freshly prepared at 280</td>
<td></td>
</tr>
<tr>
<td>284C 630</td>
<td>DBS stored frozen; freshly prepared at 280</td>
<td></td>
</tr>
</tbody>
</table>

**Specimen : 284A**

<table>
<thead>
<tr>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>CV(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>10.2</td>
<td>1.1</td>
<td>11.0</td>
</tr>
</tbody>
</table>

**Specimen : 284B**

<table>
<thead>
<tr>
<th>n</th>
<th>Mean</th>
<th>SD</th>
<th>CV(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>44</td>
<td>41.4</td>
<td>3.6</td>
<td>8.6</td>
</tr>
</tbody>
</table>

**Your result**

- Target value (ALTM): 10.2
- Standard Uncertainty: 0.2
- Your specimen
- Bias transformed bias: -23.6
- Accuracy Index: 10.0
- PE DELFIA: 10.2

**Your result**

- Target value (ALTM): 37.13
- Standard Uncertainty: 0.7
Screening System

FIG. 1. Flow diagram for a typical system for the screening of newborns.
Congenital metabolic disorders & Incidence

- Congenital Hypothyroidism (CH). 1:3000
- Congenital Adrenal Hyperplasia (CAH). 1:10,000 – 15,000
- Galactosemia (Gal). 1:18,000 – 180,000
- Glucose-6-Phosphate Dehydrogenase (G6PD) Deficiency. 1:57 (Philippines)
- Phenylketonuria (PKU). 1:15,000 – 25,000
Golden period

- Congenital Hypothyroidism 28 days
- Congenital Adrenal Hyperplasia 7 days
- Galactosemia 7 days
- G6PD Deficiency
- Phenylketonuria 21 day
Congenital Hypothyroidism

Incidence: 1: 3000

Definition
A condition characterized by absence or deficiency of thyroid SINCE birth.

Causes
- Defective development of thyroid gland
- Abnormal location (ectopic)
- Medication during pregnancy (iodine/anti thyroid)
- Inheritage deficiency of thyroid hormon
Congenital Hypothyroidism

• **Pathogenesis**
  Absent or deficiency of thyroid hormone leads to irreversible mental retardation, impaired growth and organs function
Congenital Hypothyroidism

• **Symptoms and Signs**
  - Appear normal at birth until 3 months of life
  - Large fontanel, depressed nasal bridge, umbilical hernia, difficulty in suction when feeding, choking etc.

• **Golden Period**
  Therapy before 4 weeks. The earlier the better.
Congenital Adrenal Hyperplasia (CAH)

- **Incidence**: 1: 10,000-15,000
- **Definition**: Abnormal of adrenal gland secretion due to inherited enzyme disorder
- **Causes**: Defect in gen coding
  - Autosomal Recessive
  - 90% cases are deficiency of 21-alfa-hydroxylase
Congenital Adrenal Hyperplasia

- **Pathogenesis**
  
  Deficiency enzyme 21-alfa-hydroxylase
  
  Increased testosterone
  
  Decreased aldosterone
  
  Decreased cortisol

**Symptoms and Signs**

Boy: masculine characteristic

Girl: abnormal genitalia
Congenital Adrenal Hyperplasia

• **Treatment**
  - Hydrocortisone
  - Fluodrocortisone
  - operation for abnormal genital

• **Golden Period**
  - Within 7 day after birth
Galactosemia

• Incidence  1 : 18.000 -180.000

• Definition
  - Accumulation of galactose in the body due to disorder of carbohydrate metabolism.

• Causes
  - Mostly deficient of enzyme galactose-1-phosphate uridyl transferase (GALT)
  - Autosomal recessive
Galactosemia

• **Pathogenesis**
  Accumulated galactose will yield **mental retardation** and other complications

• **Symptoms and signs**
  - Appear several days after feeding breast milk or lactose milk formula:
    - vomiting
    - jaundice
    - sepsis etc.
Galactosemia

• Therapy
  - Galactose free milk
  - Calcium supplementation

• Golden period
  - 7 days
G6PD Deficiency

- **Incidence** 1: 57 (Philippines)
- **Definition**
  Inherited hemolytic anemia due to deficiency of G6PD.
- **Causes**
  Defective genes in the X chromosome (x-linked)
G6PD Deficiency

• Pathogenesis
G6PD produces NADPH which is importance reductant to protect red blood cells. It prevent hemolysis of the red blood cells. G6PD Deficiency is trigger by some chemicals, foods, drugs and infections. In G6PD Deficiency, hemolysis leading to anemia and also hyper bilirubinemia (Kernicterus). Bilirubin is toxic to the brain and result in mental retardation
G6PD Deficiency

• **Symptoms and signs**
  Need trigger factors which lead to anemia hemolytic.

• **Therapy**
  - Avoid Fava bean, certain drugs and chemicals
  - Consult hematologist during crisis
Phenylketonuria (PKU)

• Incidence 1 : 15,000-25,000
• Definition
  Inherited disorder of protein metabolism leading to high Phenylalanine in the blood.
• Causes
  Defective enzyme phenylalanine hydroxylase (PAH)
Phenylketonuria (PKU)

• **Pathogenesis**
  Break down of phenylalanine is blocked. Accumulation of phenylalanine will cause **mental retardation** and hypopigmentation.

• **Symptoms and signs**
  - Appear normal at birth
  - Musty body odor
  - Mental retardation
Phenylketonuria (PKU)

• Therapy
  - Diet phenylalanine (low protein food)
  - Special milk formula
  - breast feeding with certain guidance

• Golden period
  21 days
