



## **Giornata Regionale SIDS, SIUD & ALTE**



# **S.I.U.D. E S.I.D.S. INQUADRAMENTO CLASSIFICATIVO E METODOLOGIA DI STUDIO**

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# Stillbirth and S.I.D.S.

**Definitions** relating to death in early life differ in different countries and in different jurisdictions.

It is important to be aware of them when comparing statistics or papers from different countries.

In order to identify ways in which perinatal deaths may be prevented, one needs a valid system of classification.

# Stillbirth and S.I.D.S.

## Definitions

<b>Fetal death</b>	< 22 week of gestation (WHO) < 24 w.g. (UK)	<i>When the conceptus exhibits no signs of life after complete separation from the mother</i>
<b>Stillbirth</b>	after 22 w.g. (WHO) after 24 w.g. (UK)  early stillbirth < 28 w.g. late stillbirth > 28 w.g.	As above
<b>Neonatal death</b>	Death following live birth < 28 days (UK) < 30 days (USA)	Exhibition of signs of life after complete separation from the mother

# Stillbirth

According to different classifications, **stillbirth** is about **ten times more common than sudden infant death**

**syndrome** (stillbirth rate in developed countries is estimated between 4.2 and 6.8 / 1000 births).

**Although rates of sudden infant death syndrome have greatly fallen over the past 10-15 years, there has been a recent slight rise in the rate of stillbirth (S.I.U.D).**

# Stillbirth

**The aim of this presentation is to provide an overview of the classification (and the causes) of stillbirth and to try to point out possible maternal risk factors.**

# Stillbirth

## Classifications

### Aberdeen clinico-pathological classification

- 1) Premature, cause unknown
- 2) Mature, cause unknown
- 3) Mechanical
- 4) Toxaemia
- 5) Antepartum haemorrhage
- 6) Maternal disease
- 7) Deformity (malformations)
- 8) Other causes

*Baird D. et al. J Obstet Gynaecol Br Emp*  
61: 433-448. **1954**

### British Perinatal Mortality Survey

- 1) Congenital malformations
- 2) Blood group incompatibility
- 3) Asphyxia (antepartum)
- 4) Asphyxia (intrapartum)
- 5) Intraventricular haemorrhage
- 6) Hyaline membranes
- 7) Massive pulmonary haemorr.
- 8) Pneumonia
- 9) Extrapulmonary infections
- 10) No anatomical lesions found

*Claireaux AE. Butterworths, London. Pp*  
191-211. **1962**

# Stillbirth

## Classifications

Naeye RL. JAMA 238: 228-229. 1977

### Placental and Fetal Pathology Classification

1) Acute amniotic fluid infection syndrome	11) Rhesus erythroblastosis
2) Abruptio placentae	12) Birth trauma
3) Premature rupture of membranes	13) Polyhydramnios
4) Congenital anomalies	14) Caesarean section
5) Large placental infarct	15) Marginal sinus rupture
6) Intervillous thrombi of placenta	16) Severe fetal undernutrition
7) Umbilical cord compression	17) Uterine rupture
8) Cord knots	18) Postmaturity
9) Placental growth retardation	19) Congenital syphilis
10) Placenta praevia	20) Other disorders

# Stillbirth

## Classifications

### Wigglesworth classification

- 1) Macerated
- 2) Malformation
- 3) Immaturity
- 4) Asphyxia
- 5) Other

*Wigglesworth J. Lancet II: 684-686. 1980*

### Extended Wigglesworth classification

- 1) Congenital defects
- 2) Unexplained antepartum fetal death **45,5 %**
- 3) Intrapartum asphyxia, anoxia, trauma
- 4) Immaturity
- 5) Infection
- 6) Other specific causes
- 7) Unclassifiable **1,9 %**
- 8) Problematic



# Stillbirth

## Classifications

De Galan-Roosen	
1) Trauma	
2) Infection	
3) Placenta/Cord disease	
4) Maternal immune system disease	
5) Congenital malformations	
6) Prematurity/Immaturity	
7) Unclassifiable	<b>18,2 %</b>

De Galaan Roosen AEM et al. Eur J Obstet Gynaecol. 103: 30-6 **2002**

ReCoDe	
A) Fetus	
B) Umbilical cord	
C) Placenta	
D) Amniotic fluid	
E) Uterus	
F) Mother	
G) Intrapartum	
H) Trauma	
I) Unclassified	<b>14,3 %</b>

Gardosi J et al. BMJ 331: 1113-7 **2005**

Tulip	
1) Congenital anomaly	
2) Placenta	
3) Prematurity/Immaturity	
4) Infection	
5) Other	
6) Unknown	<b>16,2 %</b>

Korteweg FJ. BJOG. 113: 393-401 **2006**

## ***Risk factors for unexplained fetal death***

	1967-1976	1977-1998
Unexplained fetal mortality	0.24 %	0.16 %
All fetal deaths	30 %	40 %

**Unexplained fetal death occurred later in gestation than explained and was associated with:**

**high maternal age;**

**multiparity;**

**low education** (less than 10 yrs education against  $\geq 13$  yrs);

**low and high birth weight percentile**



# **S.U.D.I.**

## ***(Sudden Unexpected Death in Infancy )***

**SUDI** is a term used for all unexpected deaths, whether the explanation is immediate, determinable after a thorough investigation or remains unknown.

Traditionally all unexplained SUDI death have been classified as

**S.I.D.S.**, but more recently if certain risk factors are present (co-sleeping, prone positioning, etc.) are preferred terms like:

*unascertained* (UK), *undetermined* (Australia), *unknown/unspecified* (U.S.)



*Sudden* and *Unexpected* terms mean that infants have generally been either completely well or have been suffering from only an apparent minor illness before death occurred.

## Infant deaths classified as S.U.D.I.

<b>Explained deaths</b>	Rapid INFECTIONS	<i>Meningitis, septicaemia, myocarditis, bronchopneumonia, massive gastro-enteritis, etc.</i>
	Unrecognised pre-existing medical conditions	<i>Metabolic disorders, unrecognised congenital abnormality, intestinal obstruction</i>
	Accidental deaths	<i>Road traffic accident, drowning, overlaying</i>
	Non-Accidental deaths	<i>Infanticide, neglect, abuse, etc</i>
<b>Unexplained deaths</b>	<b>S.I.D.S./unascertained</b>	

# **S.I.D.S.**

## ***(Sudden Infant Death Syndrome)***

In 1970's was introduced the “*three hit model*” for SIDS suggesting that sudden and unexpected death may occur if three conditions are fulfilled simultaneously:

1. An infant is at a vulnerable development stage;
2. A predisposing endogenous factor(s) is present;
3. An exogenous trigger initiates the lethal process.

# **S.I.D.S.**

## ***(Sudden Infant Death Syndrome)***

This hypothesis was later modified including “genetic risk factors” or “genetic make up” as predisposing factors, investigating the significance of mtDNA changes, complement component C4 polymorphism, polymorphisms of the Il-10 gene, ...



Sudden deaths in early life (fetal, perinatal period, infancy and early childhood) may be the outcome of a variety of **natural diseases** as well as **accidents** and **homicide**.



In any sudden death (S.I.D.S.), it is most important that a **full investigation** is carried out and that their **results are clearly presented**.

# **S.I.D.S.**

## ***(Sudden Infant Death Syndrome)***

### **Definition**

A SUDDEN AND UNEXPECTED DEATH OF AN INFANT

- under one year of **age**;
- the **onset** of the fatal episode was apparently associated with sleep;
- a thorough **investigation** of the case (including the performance of a complete autopsy, review of the circumstances of death and clinical history)

**DOES NOT PROVIDE AN EXPLANATION FOR THE DEATH**

# Complete post-mortem examination in stillbirths and infant deaths

**Radiology** is mandatory. It should be performed prior to the autopsy: antero-posterior projections and lateral views; (additional projections if necessary).

**Necropsy examination should not be contemplated in establishments where radiography is not available.**

From the literature, it is known that it contributes to the diagnosis in about 3-4 % of infant deaths and in about 25 % of unnatural deaths

*Keeling J.W. Paediatric Forensic Medicine & Pathology. Ed. Arnold Pub. (2009)*

*Arnestad M. et al. Forensic Sci. Int. 125 (2002) 262-268*

*Bajanowski T. et al. Int. J. Legal Med. 119 (2005) 213-216*

# Complete post-mortem examination in stillbirths and infant deaths

## External examination

- weights and measurements;
- detailed external examination by region (injuries, changes of uncertain aetiology, petechiae, secretions emanating from the nose and mouth);

# Complete post-mortem examination in stillbirths and infant deaths

**Photography** High quality photographs are an important part of the record of any necropsy on fetus, infants or children and are particularly important when investigating sudden deaths.

Whole-body views give a useful visual reminder of body proportions and state of nutrition.

# Complete post-mortem examination in stillbirths and infant deaths

**Microbiological investigations** are an important part of the examination of SUDI (as early as possible)

## Microbiological samples usefully taken in sudden death investigation

<i>Bacteriological samples</i>	<i>Virological samples</i>
Nose/throat/bronchial swabs Blood culture Cerebro-spinal fluid Lung Large bowel or rectal swab .....	Nose swabs/nasopharyngeal aspirates Tracheal ring Lung Heart Small intestine .....

# Complete post-mortem examination in stillbirths and infant deaths

**Toxicological investigations** are not taken routinely in many jurisdictions as part of the investigation of SUDI.

They are more likely to be done when concerns are expressed in a police report.

Useful <b>toxicological</b> samples in the investigation of SUDI	
<i>Samples</i>	<i>Toxicological agent</i>
Blood	Alcohol; Common sedatives
Urine	Common analgesics; Recreational drugs
Lung	Volatiles
Hairs	Long-term drug ingestion
Stomach contents	Common sedatives/analgesics

# Complete post-mortem examination in stillbirths and infant deaths

## **Biochemical and Metabolic investigations:**

blood samples are unsatisfactory;

vitreous, urine and cerebrospinal fluid are much more  
useful (often bladder may be empty in SUDI cases).



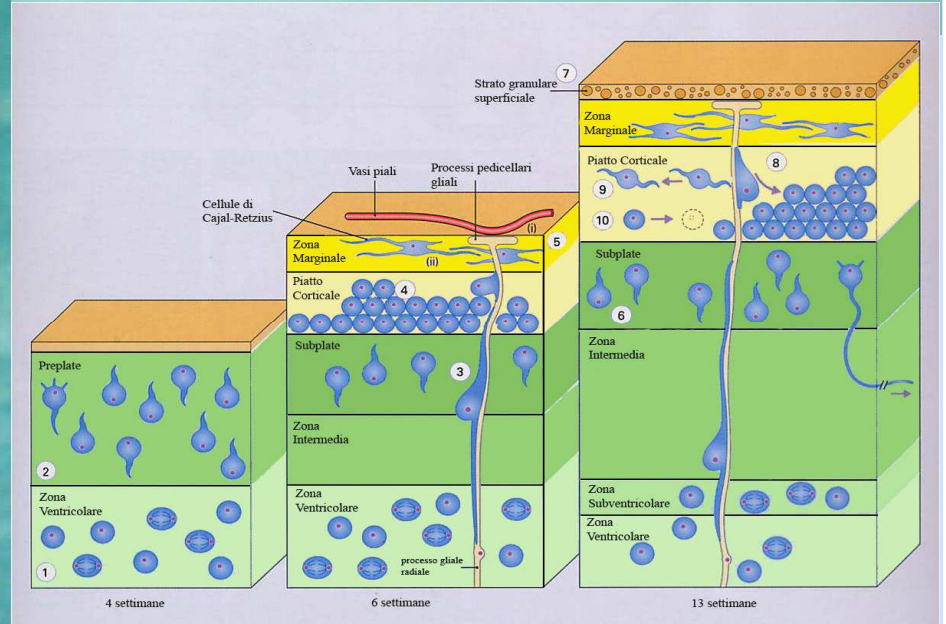
# Complete post-mortem examination in stillbirths and infant deaths

## Dissection

The task is easier when a **complete equipment** is available (digital balance, complete forceps and scissors sets).

**Relationship of organs** are observed before dissection commences (some abnormal relationships may suggest a syndrome diagnosis).

# Complete post-mortem examination in stillbirths and infant deaths



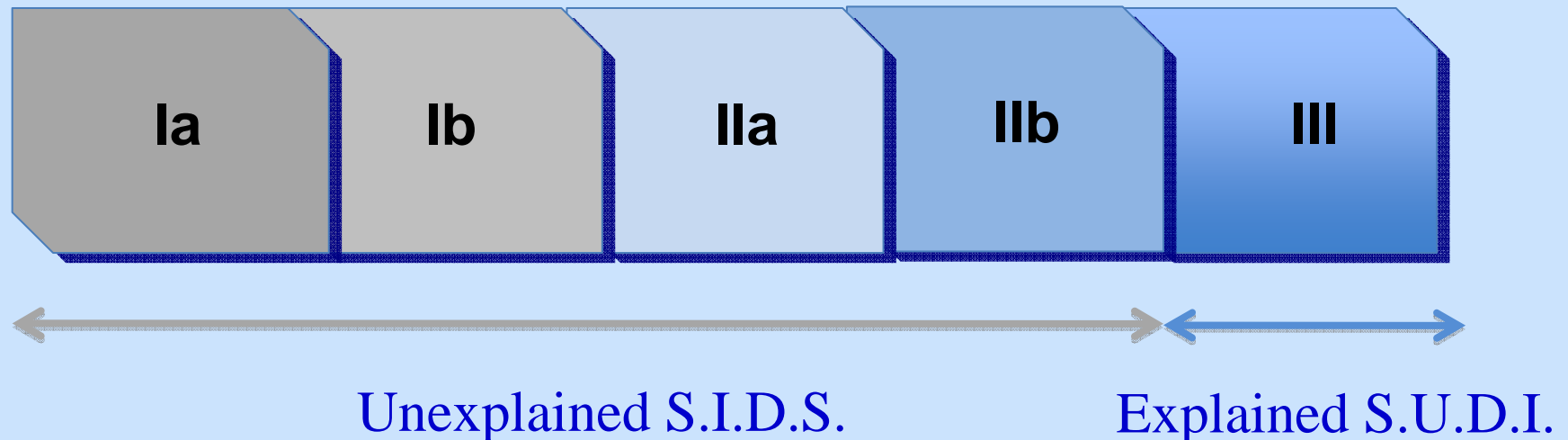
# Classification of S.U.D.I.

The starting point for the classification of S.U.D.I. will be based on the *Avon clinico-pathological system*.

This System simply **grades** the unexplained S.U.D.I. **from** those **deaths** that are **completely inexplicable** (Ia) **to those** where a **complete explanation** has been found (III).

# Classification of S.U.D.I.

## *Avon clinico-pathological system.*



**Ia:** No notable factors identified

**Ib:** Notable factors identified but not likely to have contributed to the death

**IIa:** Factor(s) identified that **possibly** contributed to the death

**IIb:** Factor(s) identified that **probably** contributed to the death

**III:** Factor(s) identified that **provide** a cause of death.

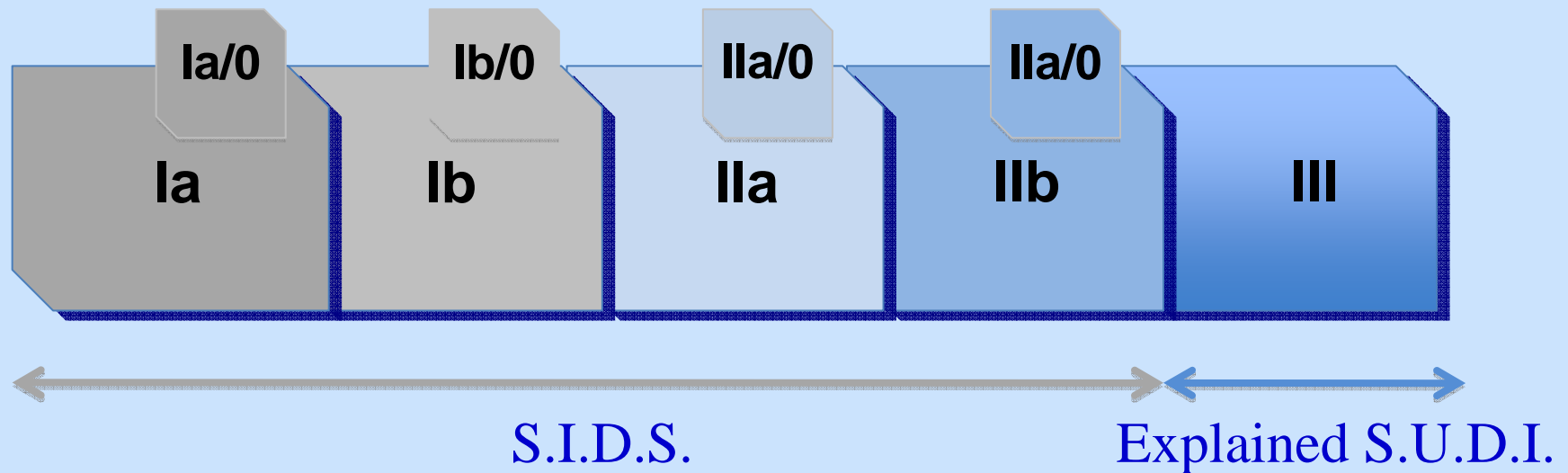
## Classification of S.U.D.I.

An expert panel that met in San Diego (2004) recognised the difficulty with **incomplete investigations** and how this may impact on a classification system.

How to distinguish between an incomplete investigation where a minor or major piece of information is missing?

They added a **classification “0”** which recognises such deaths as a S.U.D.I. but also recognises that a major pieces of information was lost and no decision could be made (explained or unexplained).

# Classification of S.U.D.I.



**“0”**: **Incomplete investigation (classified S.U.D.I.)**

**“/0”**: Extension used to denote that a potentially important piece of information is missing

**Ia**: No notable factors identified

**Ib**: Notable factors identified but not likely to have contributed to the death

**IIa**: Factor(s) identified that **possibly** contributed to the death

**IIb**: Factor(s) identified that **probably** contributed to the death

**III**: Factor(s) identified that **provide** a cause of death.



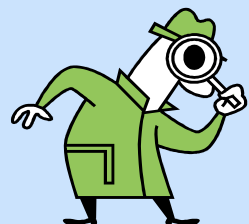


**S.U.D.I. / S.I.D.S.; S.I.U.D.**



**a multi-agency approach**





S.U.D.I. / S.I.D.S.; S.I.U.D.

a multi-agency approach



Commissione Regione Toscana  
per l'elaborazione dei percorsi organizzativi finalizzati  
all'esecuzione del  
riscontro autoptico nei casi di SIDS

*(decr. 2011 del 12/05/2008)*





**grazie**

*Capri isle, sept 2008*