

Teratogenesis

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Followings are the objectives of the lecture:

What is teratogenesis?

Different types of teratogenic agents.

Effects of teratogens on embryonic development.

Teratogenesis

Teratogen: Any chemical, physical condition, infectious agent or deficiency of that, on exposure to the foetal can alter its structure, function during its embryonic development.

Example: Consumption of certain drugs, alcohol etc. during pregnancy may affects the normal development of the foetus and cause severe structural and functional abnormalities.

Teratogenesis: The process of induction of congenital malformations in the foetus or embryo by the teratogens is termed as teratogenesis.

Teratology: Teratology is the study of abnormal development in fetus and the causes of congenital malformations or birth defects.

* Congenital malformations: Any disease or defects present from birth.

Teratogenicity: The ability of the teratogens to induce the teratogenic effects or developmental malformations.

Chemicals and drugs can not cross the placental barrier but some of them are able to do so and cause the developmental defects.

The ability of the teratogenicity depends on their ability to cross the placenta.

The Embryo is more susceptible to teratogens during the period of rapid differentiation.

Different organs are more susceptible during a particular periods of gestational development as heart first 3 to 6 week of development, central nervous system first 3 to 7 week of embryonic period.

Teratogenic agents:

- 1. Chemicals:** Alcohol, cocaine, cigarette, smoking (Nicotine) medicinal drugs (as Thalidomide, retinoic acid), heavy metals as cadmium, pollutants, pesticides, antibiotics (Tetracycline, streptomycin) etc.
- 2. Infectious agents (Pathogens):** *Zika virus, Rubella virus, Herpes simplex virus.*

3. Physical agents and Ionizing radiation: X rays.

4. Maternal factors: Gestational diabetes, malnutrition.

Some important teratogenic agents and malformations:

Teratogen	Malformations
Alcohol	Growth deficiency, mental retardation, and fetal alcohol syndrome
Cocaine	Mental retardation, brain development disorders.
Nicotine and smoking	Intrauterine growth restriction, premature delivery, miscarriage.
Thalidomide	Abnormal limb development, cardiac and gastric defects.

Retinoic Acid	Craniofacial dysmorphisms, Cardiovascular and neural tube defects, cleft palate.
Cadmium	Defective limb development, cardiovascular and neural defects
Tetracycline	This antibiotic can cross placenta. Cause Teeth and long bone anomalies.
HIV	Microcephaly, craniofacial disorder.

<i>Rubella virus</i>	Growth retardation, cardiac disorder, eye defects and mental disorder
Ionizing radiation	Microcephaly, skeletal development anomalies and mental retardation

Examples of teratogenic effects (Developmental defects):

1. **Micromelia:** The limb are short or smaller than the normal size.
2. **Meromelia:** In this defect, one or many parts of the limb are absent.
3. **Amelia:** Both pair of appendages do not develop.

4. Microcephaly: head is smaller compare to the rest of the body.

5. Microphthalmia: one or both eyes are abnormally smaller.

6. Polydactyly: Supernumerary fingers (More than five digits in one limb).

7. Oligodactyly: Fewer number of fingers (Less than five digits)

8. Syndactyly: Digits fail to separate during developments thus two or more digits fused.

9. Phocomelia: Hand or feet directly attached to the trunk part.

10. Sirenomelia: Lower limb in the form of tail or fin.

11. Hepatosplenomegaly: Liver and spleen is enlarged.

12. Cleft palate: Split or cleft in the roof of the mouth or palate region.

Incomplete syndactyly

Fingers joined part way up



Complete syndactyly

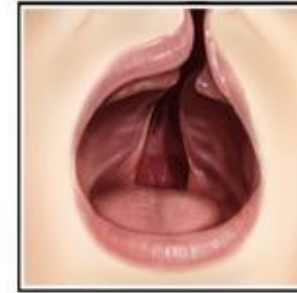
Fingers joined all the way to tip



Cleft palate



Cleft lip and cleft palate





Baby with Typical Head Size



Baby with Microcephaly



Baby with Severe Microcephaly





Microphthalmia



Phocomelia

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