NURS 821 Advanced Pathophysiology
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Course Introduction and Overview of Body's Response to Disease

Lecture 1
Body's Response to Disease
Margaret H. Birney PhD, RN

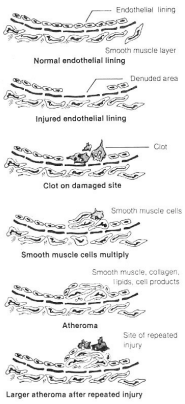
Part 3- Intrinsic Factors Relating to Disease

Vascular, Immunologic, Metabolic Genetics

Chromosomal Abnormalities

Intrinsic Factors Relating to Disease

- Vascular
  - Deranged flow
  - Obstruction
  - Bleeding
- Immunologic
  - Deficiencies
  - Allergies
- Metabolic
  - Abnormal metabolism or deficiencies of lipid, carbohydrate, protein, minerals, vitamins, fluids



Atheromatous Plaque Obstructing Blood Flow

Intrinsic Factors relating to Diseases-Primary Disorders

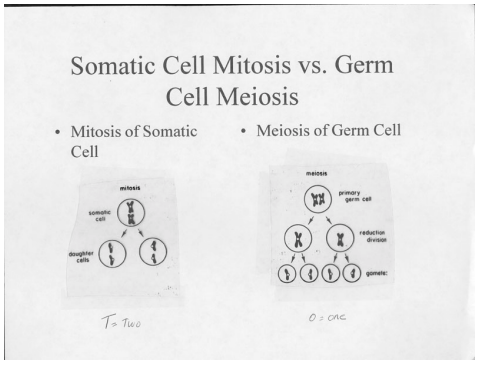
- Chromosomal abnormalities
  - Abnormal number
  - Abnormal structure
- Gene abnormalities
  - Single gene disorders
  - Sex chromosome disorders

Intrinsic Factors: Genetics

- Genetic disease-An established disease caused by abnormal genes
- Sperm and ovum each contribute 23 chromosomes to make a combined 46 chromosomes
- GAMETES REPRODUCE BY MEIOSIS-ONLY 1 CHROMOSOME FROM EACH PARENT!

Mitosis-Somatic Cell Reproduction

- All other cells produce by mitosis-duplicate chromosomes and divide –resulting in 2 daughter cells



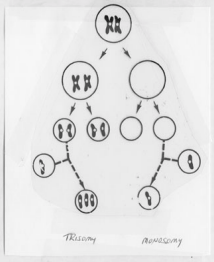
Abnormal Chromosomal Number

- Nondisjunction

Chromosomal Abnormalities

- Nondisjunction during cell division in ***meiosis***
  - **2 chromosomes go to one gamete**
  - **0 chromosomes go to other gamete**
  - **Results in abnormal number in both gametes during fertilization**
    - **Trisomy-3 homologous chromosomes or 1 extra chromosome**
    - **Monosomy-1 less chromosome**

Nondisjunction



- primary germ cell
- nondisjunction in reduction division
- gametes with extra or absent chromosome
- fertilization by normal gametes
- zygotes with abnormal # of chromosomes

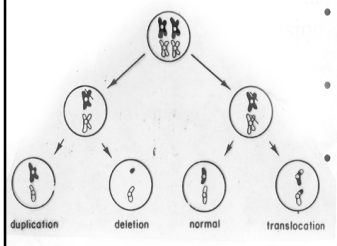
Trisomy Syndromes Resulting in Live Births

- Outcomes based on chromosome affected:
  - Trisomy 21-Down's ***Syndrome***
  - Trisomy 18-Edward's ***Syndrome***
  - Trisomy 13-Patau's ***Syndrome***

Abnormal Chromosomal Structure

- Chromosome ***breaks during cell division resulting in different cell fragments*** passing to each daughter cell
- ***Mosaicism-each cell has different genetic makeup***

Mosaicism



- Chromosome breaks during cell division
- Fragments to wrong daughter cells
- Results in duplication, deletion, normal, and translocation

Genetic Abnormalities

- Not all abnormal genes produce an abnormal genetic trait
- All genetic traits influenced by 2 genes except those on sex chromosomes
  - Recessive only expressed if parent has the same recessive gene, so both inherited genes are abnormal ***or*** if on X chromosome in male (xy)

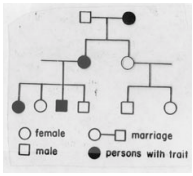
Genetic Abnormalities

- Two ways to acquire an abnormality
  - Mutation-chemical alteration
    - e.g. prenatal exposure to teratogens
      - Often occurs before pregnancy is recognized
      - All or nothing rule
  - Passage from previous generation

Single-Gene Diseases-Monogenetic

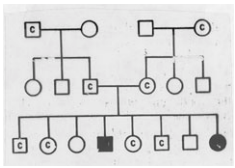
- Classically traced through family tree
- Inherited by:
  - Autosomal dominant and recessive
  - Sex-linked dominant and recessive

Single-Gene Diseases



- Family tree for dominantly inherited trait
- Abnormality appears in parent of affected person
  - Unless due to mutation or is nonpenetrant

Recessive Inherited Trait



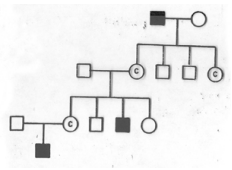
- Trait appears in ¼ of offspring of 2 parents with recessive gene
- Trait is likely absent in previous generations, although carriers likely present but undetected

Single Gene Disorders

- Autosomal Dominant
  - Familial hypercholesteremia
  - Polycystic kidney disease
  - Huntington's Disease
  - Marfan's Syndrome
- Autosomal recessive
  - Sickle cell anemia
  - Cystic fibrosis
  - Tay-Sach's disease
  - Color blindness
  - Phenylketonuria
  - albinism

Sex Chromosome Disorders

Sex-Linked Recessive Traits



- Trait only appears in males
- Abnormal gene may be passed through female carriers
- Uncles or grandfathers likely affected

Multiple Gene Disorders

- Complex gene defects involving ***more than 1 abnormal gene***
- Sometimes involve environmental factors for expression
- Difficult to define due to unclear inheritance patterns
- Often non-genetic influence

Disorders of Multifactorial Inheritance

- Cardiac defects
- Cleft lip/palate
- Hypospadius
- Pyloric stenosis
- Spina bifida
- Club foot