Tumors

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Definitions

Metaplasia is the reversible transformation of one type of terminally differentiated cell into .another fully differentiated cell type

Dysplasia is a potentially premalignant condition characterized by increased cell growth, atypical .morphology, and altered differentiation

Neoplasia is an abnormal growth of cells that persists after the initiating stimulus has been .removed

Tumour or neoplasm is a lesion resulting from neoplasia

Metaplasia

This represents an adaptive response of a tissue to environmental stress. It is mediated by changes in expression .of genes involved in cellular differentiation

It does not progress to malignancy. However, if the environmental changes persist dysplasia may result and .progress to malignancy

:Examples of metaplasia

- Change from ciliated to squamous cells in the respiratory ;epithelium of the trachea and bronchi in smokers
- Change from squamous to columnar cells in the esophageal epithelium of patients with gastro-oesophageal reflux .disease

Dysplasia

This is a potentially premalignant condition. May be a response to chronic inflammation or exposure to carcinogens. Early forms may be reversible: severe dysplasia has a high risk of progression to .malignancy e.g

 Dysplasia arising in colonic epithelium due to chronic ulcerative colitis

. Squamous dysplasia in the bronchi of smokers

Classification of tumours

Use this classification to give a differential

.diagnosis for any neoplasm

Tissue of origin. Organ and tissue type

.*Behaviour*: benign or malignant

.*Primary or secondary*

Benign tumours

Slowly growing

usually encapsulated

do not metastasize

do not recur if completely excised

.rarely endanger life

.Effects are due to size and site

:Histology

well differentiated

low mitotic rate

.resemble tissue of origin

Malignant tumours

These expand and infiltrate locally; encapsulation is rare; metastasize to other organs via blood, lymphatics, or body spaces; .endanger life if untreated

Histology: varying degrees of differentiation from tissue of origin; pleomorphic (variable .cell shapes); high mitotic rate

Invasion

Invasion is the most important single criterion for malignancy, and is also responsible for clinical signs and prognosis, as well as dictating surgical management. *Factors that enable tumours to invade tissues include*:

- increased cellular motility;
- loss of contact inhibition of migration and growth;
- secretion of proteolytic enzymes such as collagenase, which weakens normal connective tissue bonds;
- Decreased cellular adhesion.

Metastasis

It is the process by which malignant tumors spread from their site of origin (primary tumour) to form secondary tumours at distant sites. Carcinomatosis denotes extensive metastatic .disease. The routes of metastasis are as follows

.□ **Haematogenous**: via the blood stream

o Five tumours- breast, bronchus, kidney, thyroid, prostate-classically metastasize via haematogenous spread to .bone

.o Lung, liver, and brain are common sites for secondaries

.□ **Lymphatics** to local, regional, and systemic nodes

□ **Transcoelomic**: across pleural, pericardial, and peritoneal .cavities

.□ **Implantation**: during surgery or along biopsy tracks

Table Structural classification of tumours

Tissue of origin	Tumour types
Epithelium	**Benign:** papilloma, adenoma (glandular epithelium)
	Malignant: carcinoma (adenocarcinoma, squamous cell carcinoma: indicate cell types)
Connective tissue	**Benign:** fibroma (fibrous tissue), lipoma (fat), chondroma (cartilage), osteoma (bone), leiomyoma (smooth muscle), rhabdomyoma (striated muscle)
	Malignant: sarcoma. E.g. fibrosarcoma, osteosarcoma, etc. (if well differentiated). Spindle cell sarcoma, etc. (if poorly differentiated)

Neural tissue	These arise from nerve cells, nerve sheaths, and supporting tissues, e.g. astrocytoma, medulloblastoma, neurilemmoma, neuroma, etc.
Haemopoietic	The leukaemias, Hodgkin's disease, multiple myeloma, lymphosarcoma, reticulosarcoma
Melanocytes	Melanoma
Mixed origins	E.g. fibroadenoma, nephroblastoma, teratoma (all 3 germ layers), choriocarcinoma
Developmental blastomas	E.g. neuroblastoma (adrenal medulla), nephroblastoma (kidney), retinoblastoma (eye)

Carcinogenesis

Carcinogenesis is the process that results in malignant neoplasm formation. Usually more than one carcinogen is necessary to produce a tumour, a process that may occur in several steps: ***multistep :hypothesis***

- **Initiators produce a permanent change in the cells but do not themselves cause cancer, e.g. ionizing radiation. This change may be in the form of gene .mutation**
- **Promoters stimulate clonal proliferation of initiated cells, e.g. dietary factors and hormones. .They are not mutagenic**

 Latency is the time between exposure to carcinogen and clinical recognition of tumour due :to

o Time taken for clonal proliferation to produce a ;significant cell mass

o Time taken for exposure to multiple necessary .carcinogens

 Persistence is when clonal proliferation no longer requires the presence of initiators or promoters and the tumour cells exhibit .autonomous growth

Tumour growth

Tumour doubling time depends on cell cycle time, .growth function, and cell loss fraction

In tumours such as leukaemias the doubling time remains remarkably constant: the cell mass increases proportionally with time. This is exponential growth.

In solid tumours doubling time slows as size increases. .This is referred to as Gompertzian growth

Benign tumors

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A benign tumour is a tumour that lacks the ability to metastasize. Common examples of benign tumors include moles .and uterine fibroids

The term "benign" implies a mild and non-progressive disease, and indeed, many kinds of benign tumours are harmless to the .health

However, some neoplasms which are defined as 'benign tumors' because they lack the invasive properties of a cancer, may still produce negative health effects. Examples of this include tumors which produce a "mass effect" (compression of vital organs such as blood vessels), or tumors of endocrine tissues, which may overproduce certain hormones (examples include thyroid .adenomas, adrenocortical adenomas, and pituitary adenomas)

Benign tumors typically are surrounded by an outer surface (fibrous sheath) that inhibits their ability to behave in a malignant manner, many types of benign tumors have the potential to become malignant and some types, such as .teratoma, are notorious for this

Classification

The term "tumour" means "swelling", and the broadest definition of "benign tumour" encompasses ***all abnormal tissue masses which .are not cancers***

In practice, most of these entities are neoplasms, meaning that they contain a discrete population of cells which proliferate in an independent manner, usually as the result of acquired genetic .abnormalities

Entities which may be referred to as "tumors" but are non-neoplastic include developmental abnormalities, such as *hamartomas and ectopic rests (normal tissue in an anatomically .abnormal location)*

Benign neoplasms are typically composed of cells which bear a strong resemblance to a normal cell type in their organ of origin. These tumors are named for the cell or tissue type from which they originate, followed by the suffix "-oma" (but not -carcinoma, -sarcoma, or -blastoma, which are generally cancers). For example, a lipoma is a common benign tumor of fat cells (lipocytes), and a chondroma is a benign tumor of cartilage-forming cells (chondrocytes). Adenomas are benign tumors of gland-forming cells, and are usually specified further by their cell or organ of origin, as in hepatic adenoma (a benign .tumor of hepatocytes, or liver cells)

There are a few cancers with 'benign-sounding' names which have been retained for historical reasons, including melanoma (a cancer of pigmented skin cells, or melanocytes) and seminoma (a cancer of male reproductive cells)

In some cases, certain "benign" tumors may later give rise to malignant cancers, which result from additional genetic changes in a .subpopulation of the tumor's neoplastic cells
A prominent example of this phenomenon is the *tubular adenoma*, *a common type of colon polyp which is an important precursor to colon cancer. The cells in tubular adenomas, like most tumors which frequently progress to cancer, show certain abnormalities of cell .maturation and appearance collectively known as dysplasia*

These cellular abnormalities are not seen in benign tumors that rarely or never turn cancerous, but are seen in other pre-cancerous tissue abnormalities which do not form discrete masses, such as pre-cancerous lesions of the uterine cervix. Some authorities prefer to refer to dysplastic tumors as "pre-malignant", and reserve the .term "benign" for tumors which rarely or never give rise to cancer

Signs and symptoms

Benign tumors are very diverse, and may be asymptomatic or may cause specific symptoms depending on their anatomic location and tissue type. Symptoms or pathological effects of some benign tumors may include:

- Bleeding or occult blood loss causing anaemia
- Pressure causing pain or dysfunction
- Cosmetic changes
- Itching
- 'Hormonal syndromes' resulting from hormones secreted by the tumour
- Obstruction, e.g., of the intestines
- Compression of blood vessels or vital organs

Treatment

.Many benign tumors do not need to be treated at all

If a benign tumour is causing symptoms, presents a health risk, or causes a cosmetic concern for the patient, surgery is usually .the most effective approach

Most benign tumors do not respond to chemotherapy or .radiation therapy, although there are exceptions

Thank you