Cancer and Its Consequences

- Cancer is a genetic disease.
- Cancer arises through a series of somatic alterations in DNA that result in unrestrained cellular proliferation.

In Western societies one death in five is caused by cancer. The effects of tumour growth may be local or systemic. If tumour growth is not countered by treatment, the consequences may be obstruction of blood vessels, lymphatic or ducts, damage to nerves, effusions, bleeding, infection, necrosis of surrounding tissue and eventual death of the patient.

- The cancer cells may secrete toxins locally or into the general circulation.
- Both endocrine and non-endocrine tumors may secrete hormones or other regulatory molecules.
- Tumor marker is any substance which can be related to the presence or progress of a tumor.

- **local effects of tumors:**
- The local growth of a tumour can causes a wide range of abnormalities in commonly requested biochemical tests. This may be a consequence of obstruction of blood vessels or ducts, e.g. the blockage of bile ducts by carcinoma of head of pancreas causes elevated serum alkaline phosphatase activity and sometimes jaundice /elevated T.S.B.

- The symptoms which result from such local effects may be the first sign to the patient that something is wrong, but there may be no initial suspicion that there is an underlying malignancy.

- The liver is often the site of metastatic spread of a tumour. An isolated increase in the serum alkaline phosphatase or GGT is a common finding when this occur .

- Metastatic spread of a tumour to an important site may precipitate complete system failure. For example, destruction of the adrenal cortex by tumour causes impaired aldosterone and cortisol secretion, with potentially fatal consequences.

- Rapid tumor growth gives rise to abnormal biochemistry. Leukaemia and lymphoma are often associated with elevated serum urate concentrations due to the rapid cell turnover, serum lactate dehydrogenase is often elevated in these patients reflecting the high concentration of the enzyme in the tumour and the cellular turnover.

- Large tumors may not have

an extensive blood supply and the tumor cells meet their energy needs via anaerobic glycolysis. This may result in the generation of a lactic acidosis.

- Renal failure may occur in patients with malignancy for the following reasons:

*obstruction of the urinary tract.

*hypercalcaemia.

*Bence-Jones proteinuria.

*hyperuricaemia.

*nephrotoxicity of cytotoxic drugs.

- **Ectopic hormone production**
- It is a characteristic feature of some cancers that they secrete hormones, even though the tumor has not arisen from an endocrine organ.

Referred to as ectopic hormone production. hormone secretion by tumor.

- Small cell carcinomas are the most aggressive of the lung cancers and are the most likely to be associated with ectopic hormone production. Ectopic ACTH secretion causing Cushing's syndrome, an overproduction of cortisol, is the most common.

- Biochemical features of increase ACTH production include hypokalaemia and metabolic alkalosis.

- Consequences of cancer treatment

- Anti-tumor therapy can have serious effects. Gonadal failure arising from radiotherapy or chemotherapy is frequently encountered. Hypomagnesemia and hypokalaemia may be a consequence of the use of the cytotoxic drug. Patients treated with methotrexate may become folate deficient.

- Hyperuricemia is the consequence of the massive cell death which occur in the treatment of some tumors with cytotoxic drugs, particularly lymphoma and some leukemia and known as tumor lysis syndrome.

TABLE 13-1

Categories, Examples, and Locations of Tumor Markers

Categories	Example: Location of Cancer
Enzymes	Alkaline phosphatase: bone, liver, sarcoma
	Amylase: pancreatic
	Creatine kinase 1 (CK-1): prostate, small cell lung
	Lactate dehydrogenase: liver, lymphoma
	Prostatic acid phosphatase: prostate
	Prostate specific antigen: prostate
Hormones	ACTH: Cushing's syndrome, small cell lung
	ADH: small cell lung, adrenal cortex
	Calcitonin: medullary thyroid
	Chorionic gonadotropin: choriocarcinoma, testicular
	Growth hormone: pituitary adenoma, lung
Oncofetal antigens	Alpha fetoprotein: liver, germ cell
	Carcinoembryonic antigen: colorectal, GI, lung
Carbohydrate antigens	CA 15-3: breast, ovarian
	CA 125: ovarian, endometrial
	CA 19-5: GI, pancreatic, ovarian
	CA 19-9: pancreatic, GI, liver
Proteins	Monoclonal paraproteins (MC): myeloma
	Nuclear matrix protein 22: transitional cell carcinoma of urinary tract
	Bladder tumor-associated antigen: bladder
Receptors	Estrogen receptor: breast
	Progesterone receptor: breast
Genes	n-*ras* mutation: acute myeloid leukemia
	k-*ras* mutation: leukemia, lymphoma
	c-*myc* translocation: lymphoma, small cell lung
	c-*erb* B-2 amplification: breast, ovarian, GI