# Oncosurgery

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## Definition

#### •Cancer – malignant growth

Locally nonregulated tissue growth

Autonomous

Always a result of DNA mutation

- Spot mutation
- •Gene amplification
- •Deletion (loss of DNA sequence)
- •Chromosome rebuilding

# Epidemiology

- <u>Incidency</u> number of newly diagnosed cases per year (absolute x relative (per 100k))
- <u>Prevalence</u> actual number of cases alive with a specific disease (in treatment + remission)
- <u>Mortality</u> frequency of occurrence of death in a defined population
- <u>Lethality</u> number of deaths / over number of sick with a specific disease (mortality:incidence; 5-year survival)

# Epidemiology

- Most frequent in male patients
  - Prostate cancer (40th)
  - Colorectal cancer (1st)
  - Malignant tumors of trachea, bronchi, lungs (9th)
- Most frequent in female patients
  - Breast cancer (30th)
  - Colorectal cancer (9th)
  - Cervical tumors (106th)
  - Malignant tumors of trachea, bronchi, lungs (25th)

# Cancer incidency development in age groups according to WHO

• women





• men

# Cancer mortality of people up to 64 years of age in ČR compared to EU



## Etiology - noninfluenceable factors

- Genetics hereditary transfer of mutations (Wilms tumor, von Hippel-Lindau syndrome)
- (proto)oncogens high level expression in tumor cells, supressing apoptosis

# Etiology – influenceable factors

- Influenceable factors
  - Nutrition (high fibre diet, antioxidants)
  - Hormonal growth stimulation
  - Irritation (chronic inflammation)
    - Smoking (个 lungs, mouth, stomach, pancreas, urinary bladder cancer)
    - Infection (HBV+HCV, HPV, Helicobacter, EBV, HIV...)
  - Sexual behavior, workplace (tar, cancerogenic chemicals)
  - Physical factors radiation

# Virus induced oncogenesis

- HPV verruca vulgaris, ca of cervix
- EBV lymphomas, nasopharyngeal ca
- Hepatitis B, C hepatocelular ca
- HHV8 Kaposi sarcoma
- HTLV leukaemia

## Kaposi sarcoma



#### Prevention

- Primary: HBV, HPV vaccination
- Secondary: screening, self examination -> early diagnosis
- Tertiary: keeping QoL, control of progression

www.loono.cz

# Screening

- Early detection of disease (asymptomatic)
- Quick, cheap testing with high specifity
- 3 screening schemes in Czech rep.
  - Colorectal cancer > 55y (haemoccult/2y; colonoscopy/10y)
  - Breast cancer >45y (mammography/2y)
  - Cervical cancer (cervical smear/1y)

## Examination

- Anamnesis
  - Familiary (cancer occurence, early onset)
  - Polymorbidity, other diseases with likely connection with suspected cancer or influencing the therapeutic plan)
  - Work/social (cancerogens in workplace)
  - Abuse (alcohol, smoking, drug use)
  - Epidemiological
  - Gynaecological

#### Examination

- Thorough physical examination
  - Local changes (tenderness, consistency/color change, naevi changes, blood in the stool/urine
  - General changes (loss of weight >10% in 6 months, lack of appetite, intolerance of specific foods, fatigue, night sweating, fevers of unknown etiology, cough, depression....)
  - Per rectum!

#### Colorectal cancer



# Oncomarkers

- Biomarkers found in bodily fluids or tissues
- 个 levels can indicat cancer
- Screening (false positivity – Ca 125 endometriosis)
- Monitoring



# Oncomarkers

- AFP
- Ca 15-3
- Ca 19-9
- Ca 125
- CEA

- Hepatocelular carcinoma
- Breast cancer
- GIT cancer
- Ovarian, endometrian cancer, GIT
- GIT, cervix, lung, ovarian, breast cancer
- Carcinomas, sarcomas

- CYFRA
- hCG
- PSA

- Choriocarcinoma
- Prostate cancer

Site	Tumour marker	Sample type	Turnaround time	Site	Tumour marker	Sample type	Turnarour time
Oesophagus	CA 19-9	serum	4 hours	Thyroid	CEA	serum	4 hours
	SCC	serum	4 days		Calcitonin	1ml Frozen s	5 days erum
Site	Tumour marker	Sample type	Turnaround time	Site	Tumour	Sample	Turnarour
Bronchial/	NSE*	serum	10 days	Dreamt	marker	type	time 9 weeks
Lung	SCC*	serum	4 days	breast	CA 15-3	Senim	d hours
	CEA	serum	4 hours		CEA	serum	4 hours
	Uytra 21-1 TPA	serum	7 days 3 days	-			
	in A	acrum	oudys	Site	Tumour marker	Sample type	Turnarour time
Site	Tumour	Sample	Turnaround	Liver	AFP	serum	4 hours
	CASOO	type	A heuro		CEA	serum	4 hours
Bile duct	CEA	serum	4 hours		Ferritin	serum	4 hours
	CA72-4	serum	5 days				
6-1-		0		Site	Tumour marker	Sample type	Turnaroun time
Site	marker	Sample	time	Gastro-	CEA	serum	4 hours
Pancreas	CA 19-9	serum	4 hours	intestine	CA19-9	serum	4 hours
	CEA	serum	4 hours		CA72-4	serum	5 days
Site	Tumour	Sample	Turnaround	Site	Tumour marker	Sample type	Turnaroun time
The s	marker	type	time	Ovary	CA 125	serum	4 hours
Carcinoid	5-HIAA	24 hour	4 days		CA15-3	serum	4 hours
		acidified			HE4	serum	1 day
					AFP	serum	4 hours
Site	Tumour marker	Sample type	Turnaround time	Site	Turnour marker	Sample type	Turnaroun
Bladder/	CEA	serum	4 hours	Colon	CEA	serum	4 hours
Chorion	CA50	serum	5 days		CA 19-9	serum	4 hours
	NMP22	urine	3-5 days		CA 50	serum	5 days
Site	Tumour marker	Sample type	Turnaround time	Site	Tumour marker	Sample type	Turnaroun
Cervix/	SCC	serum	4 days	Testes	AFP	serum	4 hours
Uterus	CEA	serum	4 hours	10000000	Beta HCG (quantitative)	serum	4 hours
Site	Tumour marker	Sample type	Turnaround time	Site	Tumour	Sample	Turnamun
Prostate	Prostate	serum	4 hours	1000	marker	type	time
	Profile (To	otal + Free	PSA)	Bone	Bone Alk	serum	3 days
	PLAS		6 days		Phos Osteocalcin	(frozen) serum (frozen)	4 days
Site	Tumour marker	Sample type	Turnaround time	ļ		fuoroal	

#### Tumor characteristics

- Metastasizing forming new focuses in distant body parts (>3 generalisation)
- Invasion primary tumor cells -> submucosis
  - -> vessels
- Extravasation
- Angiogenesis vessel growth stimulation



# Tumor division

- Pseudotumors
  - Hypertrophy
  - Hyperplasty
  - Cyst
  - Inflamatory pseudotumor (Schloffer)
  - Hamartoma tissue not involved in the organ structure
  - Choristia cell cumulation in abnomal places

## Tumor division – biological activity

- Benign tumors limited, slow growth, do not form mts, capsulated, well differentiated x meningeoma
- Semimalignant tumors basalioma
- Malignant tumors quick, destructive growth, low differentiation, no borders, form mts
- Carcinoids potentially malignant, rare, serotonine production -> flush

#### Tumor division – biological activity



#### Precanceroses

- State preceding malignancy
- Fastened cell proliferation -> higher risk of genetic mutation
- Metaplasia (Barret's oesophagus, leukoplakia, intestinal metaplasia of stomach lining)
- Inflammation (inflamatory hyperplastic polyps in ulcerative colitis, HPV infection)
- Hyperplasty in hormone-dependant organs (endometrium, prostate)

#### Precanceroses



#### Precanceroses

- <u>stationary</u> (lower risk of malignant changes, e.g. hyperplastic reaction around chronic fistulas)
- <u>progredient</u> (Barret's oesophagus, familiary adenomatous polyposis)

#### Carcinoma in situ

- Signs of malignancy
- Latency, resting state



#### Metastases

- Selective mts (prostate ca -> axial skeleton)
- Generalised mts
- Solitary mts (lung mts in renal carcinoma)
- Lymphogenic mts (vessel -> node)
- Hematogenic mts (direct growth into vessel)
- Implantation mts (peritoneum)

#### Peritoneal carcinomatosis



#### Peritoneal carcinomatosis



#### Tumor classification

- Typing, staging, grading
- MKN-O /ICD-O/ classification
- 3-degree coding XXXX/YZ
- R classification after treatment

Histopathology – *Typing* 

- Tissue of origin
  - Mesenchymal (connective tissue –sarcoma)
  - Epithelial (-carcinoma)
  - Neuroectodermal (malignant melanoma)
  - Germinal (germinal cells, gonads seminoma, yolksac tumor, teratom)
  - Choriocarcinoma (trofoblastic cells)
  - Mesothelioma (pleura, pericard, peritoneum)

## Mesenchymal tumors

- Connective tissue tumors
  - Fibrous tissues (fibroma, myxoma, myofibroma)
  - Fat cells (lipoma, liposarcoma, xanthoma)
  - Cartilage (osteochondroma)
  - Vessels
  - Muscle cells
  - Blood & lymphatic cells (leukaemia, lymphoma, myeloma)
- Fibroma (benign) fibrosarcoma (malignant)

# Epithelial tumors

- Benign papiloma, fibroepithelioma
- Malignant squamous carcinoma, basalioma, urothelioma, adenocarcinoma (mamma, colon)
- Types
  - Covering epithelium
  - Glandular epithelium (adenomas)
  - Neuroendocrine epithelium (carcinoid)

#### Neuroectodermal tumors

- CNS, peripheral nerves, skin tumors /melanocytes/
- Types
  - CNS: Neuro-, retinoblastoma, meningeoma, astrocytoma, oligodendroglioma, feochromocytoma
  - Peripheral: Schwannoma, neurofibroma
  - Skin: naevus pigmentosus (benign), malignant melanoma
- Two tissues of different origin (mixed tumors)

# Histopathology – *Grading*

Microscopic determinated degree of tumor diferentiation Important prognostic + predictive information Higher = more sensitive to treatment

- G1 high differentiation, low malignity level
- G2 average diff., average malig.
- G3 low diff., high malignity
- G4 not differentiated tumor
- GX impossible to determine differentiation
# Histopathology – *Staging*

- Determination of clinical phase
- Precancerosis -> preclinical stage ->
   -> clinical symptoms
- TNM classification, MKN-O classification
- Dukes system colorectal cancer staging
- FIGO system cervical cancer staging
- Clark & Breslow class. malignant melanoma

# TNM Classification

- T = tumor (T0, TIS, T1-4, TX)
- N = lymph node (N0, N1-4, NX)
- M = metastasis (M0, M1, MX)

#### pTNM

- y adjuvant therapy
- r relapse of malignancy
- C certainity factor (surgery, histology, autopsy)

# Classification

- MKN-O (ICD-O; International classification of diseases for oncology)
- 3-degree coding XXXX/YZ
  - XXXX = morphological type of tumor
  - Y = biological activity
  - Z = histopathological grading

# Classification

- C24 infiltration of nonspecific parts of biliary tract
- C24.1 tumor of major duodenal papilla (Vater papilla)
- C24.1 M-8160 cholangiocarcinoma of Vater papilla
- C24.1 M-8160/3 (malig.) cholangiocarcinoma of Vater papilla
- C24.1 M-8160/32 averagely differentiated cholangiocarcinoma of Vater papilla

# R classification

- R0 without residual tumor
- R1 microscopic residual tumor
- R2 macroscopic residual tumor
- R2a macroscopic residual tumor, microscopically not verified
- R2b macroscopic residual tumor, microscopically verified

# National oncological registry

- Collecting data since 1976
- Under IARC (International agency for research on cancer)
- screening, manifestation, date of 1st visit vs. date of dg., smoking, laterality,...

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# Fundamentals of surgical oncology

- Solid tumor removal
- Acute x planned therapy
- Curative x palliative therapy
- Qol improvement (cytoreductive surgery debulking)

# Prophylactic surgery

- Inherited abnormalities
- Surgery as a primary prevention of illness

BRCA 1, BRCA 2 – prophylactic mastectomy
Familiary adenomatous polyposis – colectomy
Cryptorchism - orchidopexis

# Familiary adenomatous polyposis



# Diagnostic surgery

- Various ways of obtaining tissue sample
- Needle biopsy (CT, USG controlled)
- Explorative laparoscopy/laparotomy

# Diagnostic surgery

- Biopsy
  - FNAB (thyroid gland)
  - Core biopsy (breast)
  - Incisional biopsy (forceps endo)
  - Probatory excision





# Diagnostic surgery

Laparoscopic Procedure



# Endosurgery



# Curative surgery

- Radical surgical intervention to prevent relapse
- Multivisceral surgery removes surrounding tissues & organs with primary tumor
- Used in localised forms of illness

# Regional lymph nodes removal

- Elective
  - Prophylactic lymph node disection (no signs of dissemination in surgery + histology)
- Therapeutic
  - Removal in damaged lymph nodes (thyroid gland papilar Ca)

# Sentinel node biopsy



# Sentinel node biopsy



- Sentinel = guard
- First grade lymph node
- Ca mammae
- Melanoma

# Treatment of metastases

• Paliative surgical intervention

(lung + liver mts of CRCA)

- 1/3 increase of long term survival in colorectal cancer patients
- Ethanol instilation
- Cryodestruction
- Locoregional chemotherapy (intraarterial port-catheter)
- Solitary mts better prognosis

### Colon resection



### Colon resection



# Palliative surgery

- $\downarrow$  tumor tissue mass
- $\bullet \uparrow$  other treatments effectiveness
- Method of choice in case of imminent local complications
  - Ileotransverstotomy to alleviate symptoms of obstruction (inoperable caecal cancer)
  - Choledochojejunostomy to prevent jaundice (uresecable pancreatic tumor)

# Nonsurgical methods

- Chemotherapy
- Radiotherapy
- Hormonal / Immunotherapy
- Laser
- Cryosurgery
- Radiosurgery (gamma knife)
- Endoscopic mucosectomy

# Interdisciplinary care

- Masarykův onkologický ústav
- Indication committees
  - Mammary, Melanoma, Digestive oncology, Urology

# Interdisciplinary care

#### Members of the multiprofessional team

- Site-specialist surgeon
- Surgical oncologist
- Plastic and reconstructive surgeon
- Clinical oncologist/radiotherapist
- Medical oncologist
- Diagnostic radiologist
- Pathologist
- Speech therapist
- Physiotherapist
- Prosthetist
- Clinical nurse specialist (rehabilitation, supportive care)
- Palliative care nurse (symptom control, palliation)
- Social worker/counsellor
- Medical secretary/administrator
- Audit and information coordinator

# Special oncosurgery

# Gastrointestinal surgery

- Oesophagus
- Stomach
- Intestines + rectum
- Liver
- Pancreas, gall bladder, biliary tract

# Oesophagus

- Risk factors: alcohol abuse, smoking, GERD, Barrett's precancerosis
- Dg.: X ray passage, endoscopy, CT
- Symptoms: dysphagia, weight loss, cough, back pain
- Therapy: rt, cht, surgery

# Stomach

- Risk factors: smoking, poor food choices, infection (H. Pylori)
- Dg.: US, endoscopy, CT
- Symptoms: ditto + anemia
- Therapy: rt, cht, surgery partial/total resection, palliative - gastroenteroanastomosis

Primary tumor – hepatocelular Ca (hep C)

- Secondary liver mts (CRCA), more frequent
- Dg.: US, oncomarkers AFP
- Symptoms: from primary tumor, cirrhotic like symptoms
- Therapy: surgical metastatectomy, liver resection (segmentectomy, lobectomy)

# Pancreas, gall bladder, biliary tract

- AdenoCa (most frequent)
- Chemoresistant
- Late diagnosis
- Therapy: palliative bypass surgery, liver resection, RT

# Colorectal carcinoma

- No. 1 cause of death in males, 2nd in females in CZ (7800 newly diagnosed/year)
- Unvaforable prognosis
  - Short term troubles
  - Occurence under 30y
  - Nondifferentiated Ca
  - Infiltrating form
  - Angioinvasion
  - Lymphatic metastases

# Colorectal carcinoma

- Unknown etiology
- High fibre diet x diet rich in red meat
- Familiar anamnesis !!
- Preexisting adenomas -> precanceroses -> tu
- Colonoscopic polypectomy decreases the risk of CRCA





#### Staging of and Prognosis for Colorectal Cancer

Stage			Five-Year Survival (%)	
Dukes	TNM	Description	1940s and 1950s	1960s to Present
A	T1N0M0	Infiltration no deeper than submucosa	80	> 90
B1	T2N0M0	Infiltration of muscularis; no penetration through colonic wall; no lymph node involvement	60	85
B2	T 3-4N0M0	Extension through colonic wall; no lymph nodo involvement	45	70-75
C1	T2N1M0	Infiltration of muscularis; no penetration through colonic wall; lymph node involvement	15-30	35-65
C2	T3-4N1M0	Extension through colonic wall; lymph node involvement		
D	TXNXM1	Distant motastasos	< 5	< 5

Note: see reference 91.

# Colorectal carcinoma

- Early diagnosis -> better prognosis
- Adenomatous polyp -> Ca (10 years)
- Prevention screening (50 years >> I.+II. St. TNM 90%)
  - Haemoccult test, colonoscopy
- Follow up in risk groups
  - Adenom. polypi, FAP, UC, M. Crohn

# CRCA examination

- Anamnesis
- Examination (per rectum!)
- Rectoscopy, biopsy
- Colonoscopy / irrigography
- Lung Xray
- Ultrasound, CT, MR, PET
- Gynaecological / urological examination

# CRCA examination

- CT
  - Local tumor staging, extracolonic propagation
  - Regional lymph nodes
  - Distant mts detection
  - Virtual colonoscopy
- PET
  - Preoperative tumor detection, staging
  - Local relapse detection
- MR
  - Tumor relapse detection
  - Tu / scar tissue / postradiation changes differentiation
# CRCA surgery

- Resection
  - Radical
  - Paliative
  - Planned x acute
- Anastomoses colostomy, ileostomy
- Explorative laparotomy (ascites evacuation)
- Pain management
- Psychotherapy

# CRCA surgery

- Radical curative resection
  - Excision of ca incl. Lymph nodes en bloc
  - "no touch technique"
    - Colon ligature over + under tumor, ligation of vessels
  - Block resection (spreading to surrounding tissues)
  - Mts resection (ONLY in solitary mts in one surgery)

# CRCA surgery

- Total pancolectomy (PCE) + ileostomy (*Brooke*)
- Total PCE + continent ileostomy (Kock)
- Restorative PCE + IPAA (ileo-pouch anal anast.)
- Subtotal colectomy + IRA (ileo-rectal anast.)

# Total pancolectomy (PCE) + ileostomy (*Brooke*)

#### ╋

Permanent stomy without special training Eliminated CRCA risk

Peristomic irritation Psychological effect Urinary + sexual dysfunction



### Total PCE + continent ileostomy (Kock)

Same as PCE sec. Brooke

+

Complicated surgery Risk of pouchitis



# Restorative PCE + IPAA

(ileo-pouch anal anastomosis)

- + elimination of colorectal mucosa, continence, no permanent stomy, w/o sexual dysfunction
- ongoing small CRCA risk



Subtotal colectomy + IRA (ileo-rectal anastomosis)

No permanent stomy w/o sexual dysfunction Easy follow up

Risk of CRCA Lifelong follow up

+



### Emergency room X rays





# Hartmann's surgery



- Lower 15cm
- Special surgical approach

- Upper 1/3
- Lower 2/3



- Upper 1/3 of rectum (12-15cm)
  - Mobilisation and transection 5cm under tumor
  - Partial mesorectal excision
  - Lower anterior resection + anastomosis
    - Stapler / by hand

- Lower 2/3 of rectum (5-6cm to 11-12cm)
  - Lower anterior resection + anastomosis (colorectal/coloanal)
  - •a.+v. mesenterica inferior ligation
  - Lienal flexure mobilisation
  - Total mesorectal excision (TME)
    - 12> lymph nodes in resecate (-> TNM)
    - •<12 lymph nodes -> incorrect clinical staging

- Tumor localisation under 5-6cm
- Abdominoperitoneal extirpation of rectum sec. Miles





- Most frequent Ca in women
- Hormonally dependent
- > 30% of all malignancies
- ČR 1 in 12 women
- Europe 1 in 10 women
- USA, GB, Scandinavia 1 in women -> endemic occurence

- Sporadic occurence (spontaneous mutation)
- Familiar occurence (genetic abnormalities)
- Hereditary occurence (BRCA1, BRCA 2)

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Invasive ductal Ca (72%)
Invasive lobular Ca (13%)
Ca in situ (6%)
Erysipeloid. Ca, Paget's Ca
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- Clinical findings
  - Squamae, encrustation
  - Usuration of nipple
  - Propagation to areola
  - Propagation deep to the mammary tissue
  - 50% palpable mass -> invasive ductal Ca





#### Mammary carcinoma in men

- 1 male to 100 females per year
- 36 newly diagnosed per year
- Maximal incidency +- 70 years
- 85% infiltrative ductal Ca

# Diagnostic methods

- Ultrasound
- Mammography
- CT, PET CT
- MR
- Ductography, ductoscopy
- Laseromammography
- Transluminiscence
- Digital thermography dynamic optical breast imaging system

Prognosis according to tumor size

- Diameter of tumor in
   5year survival cm
- <1cm
- 1-3cm
- >3cm

- 99%
- 91%
- 85%

# Surgical treatment

- Breast surgery
  - Breast sparing surgery
  - Radical mastectomy
  - Reconstructive surgery
- Axillar region surgery
  - Radical exenteration
  - Sentinel node extirpation





# Sanative surgery







# Fasciocutaneous flap



### Latissimus dorsi flap



#### Postradiation risks

- Edema, altered skin sensation
- Fibrosis of mammary tissue
- Rib fractures
- Damage to lungs + heart

# Damage to the lymphatic vessels

- Fixed chronic lymphoedema -> elephantiasis
- Lymphostasis limited arm movements, feeling of heaviness in the arm, increased circumference
- Dg.: examination + lymphoscintigraphy



