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The ESSO core curriculum committee update on surgical oncology

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ABSTRACT

Introduction: Surgical oncology is a defined specialty within the European Board of Surgery within the European Union of Medical Specialists (UEMS). Variation in training and specialization still occurs across Europe. There is a need to align the core knowledge needed to fulfil the criteria across subspecialities in surgical oncology.

Material and methods: The core curriculum, established in 2013, was developed with contributions from expert advisors from within the European Society of Surgical Oncology (ESSO), European Society for Radiotherapy and Oncology (ESTRO) and European Society of Medical Oncology (ESMO) and related subspeciality experts.

Results: The current version reiterates and updates the core curriculum structure needed for current and future candidates who plans to train for and eventually sit the European fellowship exam for the European Board of Surgery in Surgical Oncology. The content included is not intended to be exhaustive but, rather to give the candidate an idea of expectations and areas for in depth study, in addition to the practical requirements. The five elements included are: Basic principles of oncology; Disease site specific oncology; Generic clinical skills; Training recommendations, and, lastly; Eligibility for the EBSQ exam in Surgical Oncology.

Conclusions: As evidence-based care for cancer patients evolves through research into basic science, translational research and clinical trials, the core curriculum will evolve, mature and adapt to deliver continual improvements in cancer outcomes for patients.

1. Introduction

More than a decade ago, the inaugural version of the ESSO Core Curriculum was launched [1]. Since then, surgical oncology has evolved, benefitting from major advances in systemic therapies, for instance immunotherapy in melanoma care, and in surgical strategies and peri-operative care.

Since the first proposal of Professor Naredi for a core curriculum for surgical oncology trainees' in 2008 [1], the role of surgical oncology has moved away from a general specialization in cancer surgery towards highly focused fields of super specialization [2]. A global curriculum [3] has been introduced as well as a curriculum for enhancing the understanding of research and trials in cancer surgery [4].

The "general" surgical oncologist has become an near obsolete entity due to the pragmatic phenomenon of further differentiation and specialization in many centres and regions. For example, breast cancer care has become the field of breast cancer specialists and in some countries breast surgeons have moved away from national surgical oncology societies [5] and hepatobiliary and pancreatic surgery has become a focused area for surgeons only performing procedures in this very specific anatomical site with a need for tailored training curricula [6–8]. However, despite this there are still huge variations in practice and discrepancies in training, both within Europe and worldwide [9–15]. In many regions, surgical oncologists are tackling a broader clinical spectrum still, if the entity of a "surgical oncologist" even exists. Hence, we should recognise the need for specialty trained cancer surgeons yet appreciate the regional variations and even the lack of access to cancer surgeons that still exists in several places.

Although surgical oncology has become too broad a field to be encompassed within a single profession, many similarities between surgical specialists active in the field of surgical oncology still exist [16,17]. Irrespective of one's area of interest, multidisciplinary care has become ever more important [18]. Therefore, a concise and focused knowledge about applicable topics outside of the surgical aspects of care is required for the modern cancer surgeon.

An up-to-date awareness of the state of the art systemic and radiotherapeutic treatment options, as well as imaging modalities, a thorough knowledge of cancer biology, epidemiology, and quality of life related issues is necessary for the cancer surgeon. Moreover, for the surgical oncology trainee who has not yet decided which direction in surgical oncology to pursue, it is essential to have a state-of-the-art overview of the critical areas of interest in the major sub-specialties within surgical oncology.

This updated core curriculum therefore, using the style and layout initiated and published in 2013 [19], offers a concise overview of all relevant aspects of surgical oncology. Notably, the curriculum will not be able to cover all specifics for every cancer. Cancer care is influenced by societal changes [20] – structurally, socially, politically, economically and – evidently also through climate change [21,22]. This has in particular been evident during the COVID-19 pandemic that has greatly influenced the care of cancer patients worldwide, with detrimental effects to planning, access to operating theatres and critical care resources, need for constructed alternative treatment pathways and need for rethinking care principles depending on the various scenarios experienced across regions [23–26]. As we are still learning from this, guidelines and structure for better preparedness for the future may come as a result from continued evaluation of this global issue.

Furthermore, the way that knowledge and information is disseminated is changing [27–29]. Social media and virtual presence have affected when, how and where information is launched, accessed, and spread. Cancer surgeons should be able to retrieve, digest and interpret data from a range of sources and incorporate relevant advances into their own practice [30].

The current version reiterates and updates the core curriculum structure needed for current and future candidates who plans to train for and eventually sit the European Fellowship Exam for the European Board of Surgery in Surgical Oncology. The content included is not intended to be exhaustive but, rather to give the candidate an idea of expectations and areas for in-depth study, in addition to the practical requirements for adequate training. The five elements included are:

1. Basic principles of oncology
2. Disease site specific oncology
3. Generic clinical skills
4. Training recommendations
5. Eligibility for the EBSQ exam in Surgical Oncology

As research into the care of cancer patients evolves through novel basic science discoveries, translational implementation from bench to bedside, and improved knowledge through trials and registries, the curriculum will change, mature and adapt to provide the best evidence for patient care [31]. So should the life-long student of cancer engage in learning and the discovery of new and better ways of managing this disease – with the hopes of one day making cancer history.

Declaration of Competing Interest

There are no conflicts of interest reported.

Acknowledgement

The Core Curriculum update has been developed with contributions from expert advisors from within the European Society of Surgical Oncology (ESSO), European Society for Radiotherapy and Oncology (ESTRO) and European Society of Medical Oncology (ESMO).

The European Union of Medical Specialists (UEMS) and the European Board of Surgery Qualification (EBSQ)

The UEMS was established in 1958 to promote the free movement of medical specialists within Europe and to ensure the highest standards of medical care. It contains 43 specialist sections, representing 40 countries and 1.6 million medical specialists and includes the European Board of Surgery (EBS). The European Board of Surgery runs a number of Specialist Examinations once or twice per year. These were first established in 1996 in a limited number of subspecialist areas. The number of sub-specialist exams has progressively increased such that they are now available in Breast Surgery, Coloproctology, Trauma Surgery, General Surgery, Surgical Oncology, Thoracic Surgery, Transplant Surgery, Transplant Medicine, Transplant Coordination, Endocrine Surgery, Emergency Surgery, HPB Surgery and Hand Surgery. The most recent sub-specialist area to offer an EBSQ is Breast Surgery, which was launched in 2010. The European Society for Surgical Oncology (ESSO) in collaboration with the EBS runs two of these examinations: the European Board of Surgery Qualification (EBSQ) in Surgical Oncology (commenced 2003) and the EBSQ in Breast Surgery (a joint initiative with the European Society of Breast Cancer Specialists, EUSOMA). The aim of these qualifications is to provide evidence of expertise in the subject at a level that would be acceptable in all European Countries and to act as a quality standard. The first part of the assessment process for the EBSQ in all specialist areas is a formal review of experience, qualifications and academic outputs.

The eligibility criteria are demanding but vary slightly between sub-specialist areas;

- Candidates must have completed specialist training in their chosen surgical discipline.
- Log Book: Candidates must submit a logbook demonstrating the number of cases they have performed of certain index procedures. These may be objectively assessed by the exam board or more objectively assessed against a set of predefined index cases.
- Training duration and quality: Candidates must submit a CV detailing the centres in which they have undergone training. It is usually specified that candidates must have completed their common General Surgical training and then undergone a variable period of training in nationally recognised centres of expertise in their specialist area.
- Referees: Candidates must have signed references from at least 1 of their trainers.
- Academic outputs: Candidates must submit evidence of peer-reviewed publications, conference presentations and training courses they have attended. These may be subjectively assessed by the exam board or more objectively by using a minimum number or a points-based system.

The part II EBSQ examinations also vary slightly in structure and content.

They are held between once and 3 times per year. They usually comprise a variable combination of either a multiple choice question (MCQ) written exam, one or more viva voce examinations or an objective structured clinical examination (OSCE).

Curricula

Running along-side the examinations are core curricula, which are intended to serve as knowledge templates for specialist surgeons. Once again, these vary in the level of detail specified according to sub-specialist area.

European training centres in surgical oncology

Training for surgical oncologists is provided by European member state accredited general surgical training programmes, in most cases supplemented with a senior level fellowship in a centre of excellence for 1 or 2 years. The latter will give the trainee advanced level competencies in surgical oncology. Such programs should include the following:

- Regular attendance at multi-disciplinary team meetings (MDTs).
- Regular professional contact with medical and radiation oncologists.
- Access to high quality medical imaging including MRI and PET-CT.
- Access to high quality pathology services, including a wide range of extended assessments such as cytogenetics, mutational analysis and immunohistochemistry.
- Regular progress reviews with formative and summative assessments of competencies in both surgical technical skills and non-surgical competencies such as communication skills, decision-making and diagnostics.

Training courses

The ESSO Core Curriculum is intended to act as a guide for the requisite level of knowledge both for the practice of surgical oncology but also for the EBSQ examination in surgical oncology.

1.0. Basic Principles of Oncology

1.1. Carcinogenesis

Sergio Sandrucci & Kjetil Soreide.

Cellular Mechanisms of Carcinogenesis	DNA Synthesis and Repair	The mechanism of DNA synthesis, DNA to RNA transcription and RNA to protein translation. The mechanisms by which genetic code mutation occurs. Role of genes such as TP53 and other tumour suppressor genes.
	Epigenetic Modification	DNA may be modified by addition of other molecules to the DNA strand which alter transcription e.g. DNA methylation. This is recognised as an increasingly important mechanism of carcinogenesis.
	Cell cycle regulation	Role of the cell cycle in cancer promotion. The phases of the cell cycle, G1/S/G2 and M and the regulatory machinery, cyclins and cyclin dependant kinases, which control progress of cells between phases should be understood. Awareness of tumour suppressors which interact with these checkpoint regulators such as TP53, p38 and the RB protein.
	Apoptosis	The biological function of apoptosis and its role in tumour suppression should be understood.
	The Telomere	A key process in carcinogenesis is immortalisation by restoration of the telomere by an enzyme called telomerase which is up regulated in most cancers. Awareness of the role of the telomere and telomerase in cellular senescence and carcinogenesis.
	Cell signalling cascades: kinases and phosphorylases	Intracellular cascades which transmit regulatory signals both from outside and inside the cell are often controlled by the level of phosphorylation of the signaling molecules. Kinases are enzymes which de-phosphorylate and phosphorylases are enzymes which phosphorylate. Alteration in the levels of these regulatory enzymes is a common occurrence in cancerous cells and is implicated in the development of many types of cancer. Awareness of these regulatory pathways and some of the more common examples of how they may be dysfunctional in cancer.
	Cell surface growth factor receptors	Cells respond to external signals from hormones in their environment. Some inhibit cellular proliferation whilst others stimulate it. Up-regulation of stimulatory growth factor receptors is implicated in carcinogenesis. E.g. the Epidermal Growth Factor Receptor type 2 (Her-2) in breast cancer. Candidates should be familiar with some of the more common examples of growth factor receptor dysfunction in cancer.
	Angiogenesis	Cancers must induce the in-growth of new blood vessels (neo-angiogenesis) to sustain growth once they exceed a few mm in size. Angiogenesis involves a range of processes including endothelial cell proliferation, migration, tubule formation and extracellular matrix degradation. A wide range of mediators are released to stimulate this process including Vascular Endothelial Growth Factor (VEGF) and Platelet Derived Growth Factor (PDGF). Some of these regulatory molecules are now targets for molecular therapies (e.g. bevacizumab).
	Oncogenes	Oncogenes are genes whose activation stimulates or facilitates cancer development. There are numerous mechanisms by which this may occur, usually related to the cellular systems listed above. Familiarity with some of the more common oncogenes such as ras and myc.
	Tumour Suppressor Genes	Tumour suppressor genes are genes whose normal function is to protect cells from potentially carcinogenic processes such as DNA damage or unnecessary cell proliferation. Aberrations in the functions of these genes play an important role in both sporadic and some of the most widely known examples of hereditary cancers (TP53, RB, BRCA).
	Metaboliser status	Carcinogens are an important cause of cancer. Some chemical agents require metabolism by the body to become activated and some are innately active, and the body metabolizes them to deactivate them. There is a range of levels of function of the enzymes which either activate or deactivate carcinogens which is a significant cause of variability in a subject's sensitivity to certain carcinogens. Familiarity with the importance of these biological processes and how they may cause variability in cancer susceptibility.
	Tumor Heterogeneity	Knowledge relating to tumour heterogeneity as identified by phenotypic and genotypic markers of single and multiple proteins and genes progressing from single receptors such as the oestrogen receptor in breast cancer to multi-gene arrays and most recently next generation sequencing. Understanding of the uses and implications of these tumour typing technologies in the evolution of personalized medicine, including intra- and inter-tumour heterogeneity, evolution over time etc.
	Tumor microenvironment	Aware of the complex interactions of the tumour associated stroma and tumour associated cells such as macrophages, fibroblasts and endothelial cells and the complex interaction between the tumour cells and its microenvironment. These interactions are increasingly recognised as important in the development of cancer, for example distinct patterns of invasion and metastases. Awareness of extracellular matrix; tumour-stroma interaction; epithelial-mesenchymal transition (EMT), immune system and immune cells etc.

1.2. Carcinogens

Sergio Sandrucci & Kjetil Soreide.

Carcinogens	Radiation	Therapeutic Radiation: Knowledge of the balance between the curative and carcinogenic potential of radiotherapy. For example, breast radiotherapy following breast conservation surgery results in a substantial reduction in the risk of local recurrence but a very small, delayed, risk of second cancers. Diagnostic radiation. Awareness of the radiation dose in a standard chest X ray, a CT scan and a mammogram and awareness of the carcinogenic potential of these imaging modalities. Hiroshima, Nagasaki and Chernobyl: Familiarity with the dose/effect curves derived from the long-term follow-up of the survivors of the nuclear attacks on Japan. For example, the increased risk of thyroid cancer following radiation exposure in survivors.
	Viruses	Certain viruses have a causal role in the development of cancer. In some cases, the virus inserts genetic material into the host genome which triggers replication. In others, the virus causes tissue damage and the resultant chronic inflammation acts as a promoter for cancer. Some cause cancer by inducing an immuno-compromised state. The following viruses are important in the aetiology of common cancers: Hepatitis B and C, Human Papilloma Virus, Human Herpes Virus, HIV, HTLV1, Epstein Barr Virus
	Disease processes	Association between chronic diseases and the development of cancer. How chronic inflammation may act as a promoter for neoplasia, either by a substance (alcohol, smoking) or virus (hepatitis) or chemical exposure (acid reflux). Being able to describe such associations for certain cancers.

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Carcinogens	Radiation	Therapeutic Radiation: Knowledge of the balance between the curative and carcinogenic potential of radiotherapy. For example, breast radiotherapy following breast conservation surgery results in a substantial reduction in the risk of local recurrence but a very small, delayed, risk of second cancers. Diagnostic radiation. Awareness of the radiation dose in a standard chest X ray, a CT scan and a mammogram and awareness of the carcinogenic potential of these imaging modalities. Hiroshima, Nagasaki and Chernobyl: Familiarity with the dose/effect curves derived from the long-term follow-up of the survivors of the nuclear attacks on Japan. For example, the increased risk of thyroid cancer following radiation exposure in survivors.
	Chemical Carcinogens	Carcinogenic chemicals were the first agents to be recognised as aetiological factors in the development of cancer (scrotal cancer in chimney sweeps due to coal tar exposure). Awareness of chemical carcinogens, including the most widely known agents: asbestos, cigarettes, vinyl chloride, coal tar.
	Diet and lifestyle	The effect of lifestyle on the development of cancer. Awareness of the links between certain cancers and the following lifestyle choices: obesity, alcohol, exercise.
	Ageing	Age and the processes of aging as a risk factor for cancer.
	Hereditary Cancer Syndromes	Knowledge of hereditary gene mutations which significantly elevate the risk of cancer. Genetic counselling, surveillance, treatment options. Awareness of the following essential genetic syndromes: BRCA 1 and 2, Hereditary Gastric Cancer Syndrome, HNPCC, FAP, Peutz Jeghers, Ataxia Telangiectasia, Retinoblastoma, Li Fraumeni, MEN-1 and MEN-2.

1.3. Epidemiology of cancer

Sergio Sandrucci & Kjetil Soreide.

Epidemiology of Cancer	Epidemiological outcomes	Recognising the importance of epidemiology in the understanding of disease patterns, aetiology, trends and for monitoring treatment effects. The study of the distribution and determinants of disease in the human population. It identifies why different populations are at risk and enables us to understand the aetiology of a disease. Understanding of the following terms: prevalence, incidence, (absolute and age adjusted), mortality (absolute and disease specific), relative and absolute risks, lifetime risks.
	Types of epidemiological research	**Observational epidemiological research** generates hypotheses about potential causation. Ideally this would be tested with a randomised trial, but cohort or case control type studies are used in most circumstances, often based on registries or population data. Clinical studies supplemented with basic science research to demonstrate a plausible biological mechanism. Understanding of Bradford Hill's criteria for causation. Understanding of the roles, indications for, strengths and weaknesses of different study types in the hierarchy of evidence: cohort study, case control study, cross sectional studies, surveys, case series, case reports. **Analytic Epidemiology:** Analyses the underlying causes within a population by sub-group analysis, identifies aetiology. Identification of associations or links between disease in the population under study and the factor that may be causal. It usually looks at the observed (O) to expected (E) ratio of disease in 2 populations with or without the causal factor. The ratio of O to E gives the relative risk (RR). The size of the RR can be analysed statistically to see if the linkage is likely to be significant or not. Subtypes include occupational, environmental, ethno-cultural, genetic. **Genetic epidemiology:** Includes segregational analysis, linkage analysis, microsatellite studies, population-based association studies and ultimately molecular genetics. Understanding of variable penetrance of different risk factors. Basic knowledge of mutations, polymorphisms, haplotypes and their inheritance. **Exploratory studies:** Useful when the cause of a disease is not known Looks at all variables and attempts to find associations. Usually 2 populations are studied with high and low disease risk and data on as many characteristics is collected. Caution is needed as may be subject to bias. Useful for generation of hypotheses to be tested
	Sources of bias in epidemiological studies	**Recall bias:** Who can recall how much they weighed many years earlier for example: problems with case control studies. **Response bias**: Are those who take part in the study different to those who do not. **Berkson's bias**: Relates to bias in studying hospitalised patients, e.g. lung cancer and smoking. Smoking causes more hospitalization than just lung cancer and the hospital population likely differs from the normal population in smoking rates. **Confounding**: arises when a variable influences both the dependent and the independent variable, causing a spurious association between both. **Temporality:** In cohort studies this isn't a problem but in case controls, it is more difficult to be sure that exposure preceded the development of the disease. **Stage migration:** Understanding the phenomenon of stage migration (Will Roger's) in explaining observed differences in clinical outcomes

1.4. Screening for Cancer

Sergio Sandrucci, Jos van der Hage & Kjetil Soreide.

Screening for cancer	General principles of screening	Principles of screening (Wilson and Jungner 1968): Important clinical disease, treatable, recognisable early or latent phase, effective, acceptable screening test available, cost efficacy. How current and investigational screening programmes measure up to these criteria.
	Risks of Screening	Over-diagnosis: understand concept and likely effect size in current screening programmes. Over treatment: i.e. treatment for disease which would never have threatened life (low grade DCIS in an elderly female) may be treated with mastectomy with little or no benefit.

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Screening for cancer	General principles of screening	Principles of screening (Wilson and Jungner 1968): Important clinical disease, treatable, recognisable early or latent phase, effective, acceptable screening test available, cost efficacy. How current and investigational screening programmes measure up to these criteria.
		Anxiety: understand sources of anxiety for screened individuals and how they may be offset or minimised. Morbidity of the screening test: endoscopy, biopsy, radiation, pain, inconvenience. Costs of screening both to the individual and the service provider (state run schemes).
	Benefits of Screening	Earlier stage at diagnosis: aware of evidence from different cancer screening programmes. Reduced treatment morbidity due to earlier stage: aware of evidence. For example, reduced rate of mastectomy with breast screening. Reduced mortality: aware of evidence for screening in all major cancer sites.
	Types of Screening	**Breast cancer.** Screening modality, frequency, age range, efficacy and risks. High risk screening with MRI. **Cervical cancer:** Screening modality, frequency, age range, efficacy and risks. **Ovarian cancer:** evidence for and against, modalities under evaluation, on-going trials. **Colorectal cancer:** modalities (endoscopic, Faecal occult blood), frequency, age range, risks and efficacy **Gastric cancer:** modalities used (barium and endoscopic), which countries have programmes, efficacy and reason for non-utilisation in European states **Prostate Cancer:** arguments for and against. Modality (PSA), on-going trials. Risks and benefits. **Lung Cancer:** Current trials, (CT, blood tests), methods and arguments for and against.
	Bias in Screening	Lead-time bias, length-time bias

1.5. Clinical Trials and Research Methods

Sergio Sandrucci & Kjetil Soreide.

Clinical Trials and Research Methods	Trial design	Randomised Controlled Trial: Understanding of the principle of randomisation and why it is regarded as the gold standard trial design. Methods of randomisation. Blinding. Placebo controlled. Per protocol and intention to treat analysis. Instances where a randomised controlled trial is not appropriate or feasible. Understanding of the hierarchy of research evidence and its pre-eminence therein.
		Cohort study: Understanding of the principles of this type of study, the potential for bias between groups, how to minimise this. Understanding differences between retrospective and prospective cohort studies. When such a methodology is (and isn't) appropriate. **Case control:** Understanding of the principles of this type of study, the potential for bias between groups, how to minimise this. When such a methodology is (and isn't) appropriate. **Phases I, II and III and IV trials:** Understanding the difference in design and intent. **Qualitative research methods, questionnaire design and validation, quality of life methodologies**: Understanding of the appropriate indications for these methods, their limitations and strengths. **Health economics:** Basic understanding of the importance of health economics to clinical practice. Understanding of Quality Adjusted Life Years (QALY). **Systematic reviews and meta-analysis:** Understanding of how to perform a systematic literature review. The importance of meta-analysis, its limitations and strengths. **Audit:** Understanding of the audit cycle and how to design and conduct a good quality audit project. Understanding the importance of audit in quality control and quality improvement. Awareness of key national and international audits related to surgical oncology practice.
	Trial regulation	**Research Ethics.** Aware of the declaration of Helsinki and the ethical issues relating to research. Aware of special issues relating to children and mentally incompetent adults (dementia, the unconscious patient). Understanding of the informed consent process. **Monitoring and conduct:** Aware of National and European legislation. Aware of Good Clinical Practice (GCP) Guidelines. **Trial registration:** importance of registration; mandatory to avoid non-publication of negative trials, should commence before trial starts etc. **Data protection and confidentiality**: Aware of the need to protect patient confidentiality in all aspects of their clinical and research activities. Legal requirements specific to their National legislation. Aware of the security issues relating to electronic data storage devices.
	Statistical analysis	**Sample size calculation**: Understanding the importance of a pre-study sample size calculation, the parameters on which this is based and how this is performed. **Statistical analysis techniques**: Understand null and alternative hypotheses, understand the appropriate use of a range of parametric and non-parametric tests for statistical analysis. Normal and non-normal population distribution. Type 1 and 2 statistical errors. P values and confidence intervals. Able to critique a research paper in terms of its statistical design and analysis. Relative and absolute outcome measures. Primary and secondary endpoints in a trial. Able to interpret data in a research paper.

1.6. Radiation Biology

Jesper Grau Eriksen & Kim Benstead on behalf of ESTRO.

Mechanism of action	Direct DNA damage	Radiation (RT) induces DNA damage: normal cells can repair sub-lethal DNA damage whereas tumour cells often have relatively impaired repair mechanisms. This differential is exploited in RT. Radiation damage to the DNA may be as double strand breaks, single strand breaks, base damage and DNA-DNA and DNA-protein cross-links.
	Oxygenation	Oxygen stabilises radiation produced free radicals which then contribute to DNA strand breaks. Hypoxic areas of a cancer are therefore relatively radio-resistant. As a tumour shrinks during fractionated treatment, more areas become oxygenated and therefore sensitive to radiotherapy.
	Radio-resistance	Certain molecular markers suggest relative radio-resistance: hypoxia, P21 and P53 mutations and a low proliferation rate. Absence of HPV- influence in head and neck cancer patients (HPV-positive HNSCC are more radiosensitive).
Types of radiotherapy	**External beam**	May be delivered as electrons, photons or protons. Tumour targeting is achieved by beam collimation and image guidance, shielding and selection of the optimal type of radiation and energy which dictates the depth of penetration. Electrons are negatively charged subatomic particles which have a relatively low penetration depth (up to ~6 cm). Photons (X rays/gamma rays) can pass through the body (energy dependant) and can target tumours at any depth. Protons of a given energy have a certain range and very few protons penetrate beyond that distance. The dose delivered to tissue is maximum over the last few millimetres of the particle's range (Bragg peak).
	IMRT	Intensity modulated radiotherapy (IMRT); Highly targeted RT using computer and CT controlled multiple beams with automatic collimation in linear accelerators. Used in avoiding radiation damage to critical structures and target dose escalation such as CNS in sarcomas, parotid gland in head and neck cancers, bowel in prostate cancer etc.
	Brachytherapy	Direct placement of radioactive sources into the tumour or tumour bed. Able to deliver higher focal RT doses with relative sparing of normal tissue due to rapid dose fall-off around the sources. E.g. Iridium 192 after-loading for cervical and breast cancer, radioactive iodine seeds for prostate cancer. These produce mainly electrons and photons.
	Intra-operative	Several applications for intra-operative radiotherapy such as in breast conservation surgery.
	Stereotactic radiotherapy	Systems such as cyber knife, external beam radiotherapy, tomotherapy, gamma knife or linear accelerator based used to deliver RT to the brain, liver and lung metastases and small primary tumours. They may achieve highly targeted treatment areas by means of multiple highly collimated beams with a need for precise fixation of the target area.
	Proton therapy	Protons can be precisely targeted, at a well-defined range and release most of their energy in the last few mm of this range. Protons are useful for specific indications (e.g. chordoma, ocular melanoma). Limited equipment availability.
	Radio-pharmaceuticals	Use of Iodine 131 bound either to thyroxine or Meta Iodo Benzyl Guanidine (MIBG) to treat thyroid cancer or neuroendocrine tumours.
Side effects	**Acute (within 3 months from start of treatment)**	Skin desquamation, nausea, diarrhoea, oedema. Specific side effects by disease site (proctitis in pelvic RT, dysphagia in head and neck RT etc).
	Chronic (more than 3 months after start of treatment	**Radiation fibrosis, vascular obliteration:** complex cellular mechanism including myofibroblast activation and up regulated fibrogenesis, fibrogenic cytokine release, hypoxia due to enhanced atherosclerosis, endarteritis obliterans. **Second cancer development**: typically occurs with a rate of 1:1000, from 5 to 15 years and later after exposure. E.g. soft tissue and bone sarcoma, breast cancer or skin cancer. **Organ damage** depending on total and fraction dose, volume and treatment time: pulmonary fibrosis, stricture, neuropathy, transverse myelitis, blindness, dementia, poor wound healing, joint contracture, infertility, lymphoedema). Different organs have different thresholds.
Dosing and administration	**Fractionation**	Radiotherapy is fractionated to allow time for normal cells to recover from damage whilst tumour cells have a reduced capacity to recover. Doses of 1.8–2.0 Gy are typical. Dose, dose/fraction and number of fractions/week can be manipulated in order to increase tumour cell killing, reducing acute and late morbidity. The sensitivity of a tumour to radiotherapy can, in certain cases, be manipulated by sensitizers such as concurrent chemotherapy but will also affect normal tissue toxicity.

1.7. Principles of Chemotherapy and Targeted Molecular Therapies

Tanja Cufer, Lordick, Kalijn Bol, Dario Trapani, Elisa Onesti & Teresa Amaral on behalf of ESMO Leaders Generation Program Class of 2019.

Chemotherapy	General Principles	Tumours have a subpopulation of actively dividing cells termed the growth fraction, other cells will be in growth arrest or necrotic. The growth fraction cells tend to be the ones that are most sensitive to chemotherapy. Some agents act only in certain cell cycle phases whereas others may act at any cell cycle phase. Agents may act by a range of mechanisms to damage DNA, prevent DNA synthesis or arrest the cell cycle. Principles of combination chemotherapy to reduce the occurrence of drug resistance. Regime types by intent: induction, consolidation, adjuvant, neoadjuvant and maintenance.
	Side effects	Understanding of key common toxicities for chemotherapy generally and more detailed toxicity profiles for agents relative to their field of specialization.
	Drug classes	**Alkylating agents:** Platinum agents (cisplatin, oxaliplatin and carboplatin), ifosphamide, cyclophosphamide, melphalan. **Antimetabolites:** 5 fluourouracil, capecitabine, gemcitabine, methotrexate **Cytotoxic antibiotics**: Bleomycin, doxorubicin, epirubicin, mitomycin C **Mitotic inhibitors:** Taxanes, vinca alkaloids **Topoisomerase inhibitors:** Etoposide, irinotecan
	Dose modification	Aware of dose calculation and need for modification in renal and hepatic impairment and impact of age on tolerance.
Endocrine therapies	**Breast cancer**	Tamoxifen and other SERMS (raloxifene): indications, contraindications, side effects and mode of action. Aromatase inhibitors: indications, contraindications, side effects and mode of action. Fulvestrant: indications, contraindications, side effects and mode of action.
	Prostate cancer	Oestrogens LHRH partial agonists: goserelin, leuprolide Anti-androgens New agents, e.g. abiraterone Immunotherapy: Sipuleucel T
	Thyroid cancer	Thyroxine (for TSH suppression)

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Chemotherapy	General Principles	Tumours have a subpopulation of actively dividing cells termed the growth fraction, other cells will be in growth arrest or necrotic. The growth fraction cells tend to be the ones that are most sensitive to chemotherapy. Some agents act only in certain cell cycle phases whereas others may act at any cell cycle phase. Agents may act by a range of mechanisms to damage DNA, prevent DNA synthesis or arrest the cell cycle. Principles of combination chemotherapy to reduce the occurrence of drug resistance. Regime types by intent: induction, consolidation, adjuvant, neoadjuvant and maintenance.
Targeted molecular therapies	**Small molecule targeted therapies**	Agents which directly target the regulatory mechanism of cells. Broad range of targets. Can penetrate the plasma membrane to interact directly with the cellular machinery. Includes tyrosine kinase inhibitors such as imatinib (CML, GIST), sunitinib (GIST and renal cell cancer) gefitinib (NSCLC) and erlotinib (NSCLC and pancreatic cancer). Awareness of the classes of agents, molecular mechanisms and new agents under trial (DNA demethylating agents, histone deacetylase inhibitors)
	Monoclonal antibodies	Basic principles of immunotherapy. Classes of antibody (murine:omab, chimeric:ximab, humanised: zumab and human: mumab) and implications for immunogenicity. Act by binding antigens on cell surface or growth factors. Aware of key targets and therapeutic examples, side effects, cost issues. E.g. Trastuzumab for EGFR2 in breast cancer, rituxumab for CD20 of B cell lymphoma, bevacizumab for VEGF.
	Prophylactic vaccines	Human papilloma virus vaccines (Cervarix and Gardasil). Hepatitis B surface antigen to prevent both hepatitis and therefore HBV associated hepatocellular carcinoma.
	Therapeutic vaccines	Bacille Calmette-Guerin for the treatment of bladder cancer. Sipuleucel-T for the treatment of prostate cancer (attacks a prostate specific antigen, prostatic acid phosphatase.
	Cytokines	Granulocyte colony stimulating factor: mechanism of action, indications for use (filgrastim). Erythropoetin: for chemotherapy related anaemia.
	Immuno-oncology	Influence on immune system, PDL1 inhibitors etc; melanoma, lung cancer, others

Excludes treatments for leukemias and lymphomas as these are not part of surgical oncology.

1.8. Principles of Systemic therapy for Solid Cancers

Sergio Sandrucci & Kjetil Soreide.

Systemic Therapy	General principles	To become knowledgeable about the existence of different types of systemic therapy and their role in multimodality cancer treatment Awareness of the existence of the different types of systemic therapy (chemotherapy, endocrine therapy, targeted therapy and immunotherapy) Understanding the aim and role of systemic therapy in the neoadjuvant, adjuvant and metastatic setting and potential influence on surgery and outcomes. Appreciation of the importance of the multimodality approach to treat patients with early and advanced solid tumours to achieve a better outcome Ability to discuss multidisciplinary treatment at multidisciplinary tumour board and with the patients Awareness of drug resistance and the principles to prevent or overcome treatment resistance, such as combination regimens Knowledge of the intentions of treatment regimens (curative, palliative intent) and the importance of the intent for treatment decisions Awareness of different routes of administration of systemic therapy (e.g. oral, intravenous, subcutaneous, intramuscular) and availability of implantable devices for administration (e.g. port-a-cath, peripherally inserted central venous catheter, intraperitoneal catheter, intrathecal pumps) Knowledge of locoregional treatment with some anticancer agents as (e.g. limb perfusion, hyperthermic intraperitoneal chemotherapy, liver-directed therapy, intratumoral injection) Awareness of clinical and radiological criteria to assess the response to anticancer treatments, such as the Response Evaluation Criteria in Solid Tumours (RECIST) Awareness of the key clinical factors that are important for treatment decisions (such as performance status, age, presence of comorbid illnesses, prior therapies and organ functional status) Awareness of the importance of clinical trials for development of novel anti-cancer drugs, their place in the treatment of cancer patients and access to novel drugs
Biomarkers	**General principles**	Understanding the difference between diagnostic, prognostic and predictive biomarkers (clinical and molecular) and their impact on course of disease and treatment selection Knowledge of the importance of using prognostic and predictive biomarkers in the treatment-decision process and the need of tumor tissue or liquid biopsies for individualized treatment approach Knowledge of the importance of tumor tissue, liquid biopsy or re-biopsy to determine acquired resistance/biomarkers to tailor systemic therapy (personalized systemic treatment approach)
Chemotherapy	**General principles**	Awareness of the availability of different types of cancer chemotherapy agents (e.g. alkylating agents, antimetabolites, cytotoxic antibiotics, mitotic inhibitors, topoisomerase inhibitors) Awareness of the numerous indications for chemotherapy Knowledge on the general mechanism of action of chemotherapeutics (interference with cell division, e.g. by mechanisms to damage DNA, prevent DNA synthesis or arrest the cell cycle) Knowledge on the main principles of chemotherapy dosing and how to adopt it to individual tolerability
	Toxicity & interactions	Knowledge of main toxicity associated with chemotherapy (e.g. febrile neutropenia, anaemia and thrombocytopenia, nausea and vomiting, cardiac toxicity, peripheral neuropathy, gastroenteritis) and more detailed toxicity profiles for agents

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Systemic Therapy	General principles	To become knowledgeable about the existence of different types of systemic therapy and their role in multimodality cancer treatment Awareness of the existence of the different types of systemic therapy (chemotherapy, endocrine therapy, targeted therapy and immunotherapy) Understanding the aim and role of systemic therapy in the neoadjuvant, adjuvant and metastatic setting and potential influence on surgery and outcomes. Appreciation of the importance of the multimodality approach to treat patients with early and advanced solid tumours to achieve a better outcome Ability to discuss multidisciplinary treatment at multidisciplinary tumour board and with the patients Awareness of drug resistance and the principles to prevent or overcome treatment resistance, such as combination regimens Knowledge of the intentions of treatment regimens (curative, palliative intent) and the importance of the intent for treatment decisions Awareness of different routes of administration of systemic therapy (e.g. oral, intravenous, subcutaneous, intramuscular) and availability of implantable devices for administration (e.g. port-a-cath, peripherally inserted central venous catheter, intraperitoneal catheter, intrathecal pumps) Knowledge of locoregional treatment with some anticancer agents as (e.g. limb perfusion, hyperthermic intraperitoneal chemotherapy, liver-directed therapy, intratumoral injection) Awareness of clinical and radiological criteria to assess the response to anticancer treatments, such as the Response Evaluation Criteria in Solid Tumours (RECIST) Awareness of the key clinical factors that are important for treatment decisions (such as performance status, age, presence of comorbid illnesses, prior therapies and organ functional status) Awareness of the importance of clinical trials for development of novel anti-cancer drugs, their place in the treatment of cancer patients and access to novel drugs
		Awareness of the importance of dose modification in elderly, renal and hepatic impairment Awareness that different types of systemic therapy have different toxicities Awareness that toxicities of systemic therapy can have an early or late onset, can be temporary or persistent and can be (cumulative) dose dependent or non-dependent Awareness of food–drug interactions for anticancer agents Awareness of drug–drug interactions (especially anticoagulants, drug–herb and drug–nutritional supplement interactions) for anticancer agents
Endocrine therapy: (anti) hormonal agents	**General principles**	Awareness of the availability of different types of systemic endocrine therapy (selective estrogen receptor modulators, aromatase inhibitors, estrogen receptor antagonist, androgen deprivation therapy, GnRH/LHRH agonist/antagonist, thyroid hormones) and other strategies of endocrine manipulation (orchiectomy, oophorectomy) Awareness of various indications for endocrine therapy Knowledge on the general mechanism of action of endocrine therapy (interference with hormonal-dependent growth of cancer cells)
	Toxicity & interactions	Knowledge of main toxicity associated with endocrine therapy (e.g. hot flushes, cardiovascular events, loss of libido, bone density loss, cognitive disfunction, depression) and more detailed toxicity profiles for agents
Targeted therapy	**General principles**	Awareness of the availability of different types of targeted agents (small molecule inhibitors, monoclonal antibodies) Awareness of the extending indications for targeted therapy in several cancer types Awareness of importance of sequential targeted therapies and the role of tumor tissue/liquid re-biopsy for proper selection of sequential therapies Knowledge on the mechanism of action of targeted therapy (direct targeting of specific signaling pathways involved in the growth or survival of cells) Awareness that biomarker determination by comprehensive sequencing techniques and available tumor tissue material or ctDNA are crucial for rational targeted therapy Knowledge of the use of molecular biomarkers (genetic alterations in EGFR, ALK, KRAS, HER2, BRAF, etc.) for the selection of targeted agents in the treatment of specific cancer types
	Toxicity & interactions	Knowledge of main toxicity associated with targeted therapies (e.g. rash, hypertension, cough and dyspnoea, nausea, diarrhoea) and more detailed toxicity profiles for agents
Immunotherapy	**General principles**	Awareness of the availability of different types of immunotherapy (immune checkpoint inhibitors, cell therapy, therapeutic vaccines, cytokines, BCG treatment) Awareness of the extending indications for cancer immunotherapy Awareness of the benefits and shortages of using combined immunotherapy schemas or combinations of immunotherapy with chemotherapy or radiotherapy. Knowledge on the general mechanism of action of immunotherapy (boosting the immune system to attack cancer cells, no direct cytotoxicity) Awareness that unconventional patterns of response can occur with immunotherapy including hyperprogression, late responses or regression after progression Appreciation that immunotherapy has the potential for achieving responses of long duration
	Toxicity & interactions	Appreciation of a unique spectrum of immunotherapy toxicity caused by immune-related reactions effecting normal tissues Familiarity with immune-related adverse events (rash, colitis, pneumonitis, endocrinopathies, hepatitis, etc.) and main preventive and treatment strategies (e.g. glucocorticoids) to overcome it
Supporting treatments		Awareness of the importance to provide supporting treatment during systemic therapy (e.g. hematopoietic growth factors, anti-emetics, nutrition, transfusions, fluids, bone-modifying agents) for primary or secondary prevention Awareness of the usage of hematopoietic growth factors (granulocyte colony stimulating factor, erythropoietin) with certain treatment regimens Awareness of the different emetogenic potential of treatment regimens and usage of appropriate antiemetic therapy prophylaxis and therapy Awareness of the importance of nutritional status and indications for nutritional counselling support during systemic treatment and surgical approaches to improve nutrition status Awareness of the risk of infertility due to systemic treatment and fertility preservation options Awareness of the importance of palliative care support and pain management for patients receiving systemic therapy) Awareness of the importance of psychological support for patients and caregivers

1.9. Palliative and end of life care

Sergio Sandrucci & Kjetil Soreide.

Palliative and end of life care	Symptom control	WHO tiered pathway for adequate pain control. Role of multidisciplinary teams, alternatives to non-operative/non-interventional palliation and interventional/surgical palliation. Specific interventions for specific palliative issues. Advanced techniques for pain control and relief of nausea and vomiting. Types and modes of administration of opiates, side effects, dose escalation regimes. TEMS machines, acupuncture, implantable devices such as epidurals for intractable pain. Different anti-emetic drug classes and mechanism of action. Indications and contraindications. Appetite stimulants and nutritional support.
	Living wills and advanced Directives	Aware of the legal importance of living wills and advance directives and how these may be arranged by patients. Preferences for the place of death (home, hospice, hospital). Do not resuscitate (DNR) orders.
	Physical support in the home	Aware of the need for social care and physical support in the home and how this may be provided.
	Social and financial Support	Aware of the financial implications of terminal illness and how patients may obtain advice and support in their local health system
	Family and carer issues	Bereavement counselling, communication

1.10. Psycho-Oncology and Communication Skills

Sergio Sandrucci & Kjetil Soreide.

Psycho-oncology	Acute Psychological impact of a cancer Diagnosis	Candidates should have a good understanding of the psychological impact of cancer, at all stages of the cancer journey. These include denial, shock, fear of death, acute anxiety.
	Influence of pre- existent psychological/psychiatric illness	May have a profound effect on ability to cope with the diagnosis and treatment. Understanding of how to identify relevant pre- morbid illness and risk factors for severe psychological distress or illness. Understanding of how to support and treat.
	Long term psychological impact of cancer	Depression, chronic anxiety, post-traumatic stress disorder.
	Methods for psychological support	Good informational support. Emotional and psychological support through good doctor patient relationship, nurse specialists, psychologists, empowerment by involvement in decision making.
Communication skills	**Patient counselling**	Aware of ideal techniques for patient communication, the role of written and verbal information.
	Breaking bad news	Aware of ideal technique of communicating bad news. Importance of environment and support, verbal as well as body language, able to interpret and be guided by patient reactions to guide speed and level of consultation. Importance of family and friends for support. Importance of specialist nurse support. Verbal and written information.
	Shared decision-making facilitation	Aware of importance of involving patient in decision making about their care where possible and at the level they desire. Aware of tools to aid in decision making. Aware of variation in decision making styles and preferences and level of desired knowledge between patients. Aware of and respects patient's preferences.

2.0. Disease Site Specific Oncology

2.1. Breast Cancer

Yazan Masannat, Isabel Rubio & Linda Wyld.

	Basic Knowledge	Advanced Knowledge
Physiology of the Breast	Breast Development. Lactational changes	Developmental abnormalities (tubular breast, hypoplasia, hyperplasia, Poland's Syndrome)
Surgical Anatomy	Surgical anatomy of the breast and axilla	Chest Wall anatomy (Pectoralis Major and Minor, Serratus and LD) For Implant Based Reconstruction Chest Wall Perforator Flap Anatomy
Incidence	1:8 in Europe. Increasing incidence	Factors contributing to increase risk: lifestyle (reduced number of & later pregnancy, obesity, alcohol, aging population) and the effect of screening over-diagnosis. Awareness of age & race specific variance in cancer incidence.
Aetiology	Age, nulliparity, obesity, alcohol, oestrogen, radiation, familial.	Detailed awareness of the relative risk of aetiological factors and the evidence base and underpinning mechanism of effect. Risks of HRT, the pill. Protective effect of oophorectomy, anti- oestrogens.

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	Basic Knowledge	Advanced Knowledge
		Risk estimation and risk calculator tools (Gail, Claus, Tyrer Cuzick, BOADICCEA)
Genetics	Aware of BRCA1 and 2 and their effect on breast and ovarian cancer risk Management strategies for confirmed gene carriers. Aware of other genetic cancer syndromes (e.g. Li-Fraumeni) and their effect on breast cancer risk	BRCA1 and 2: The effects of carriage of a BRCA1 or 2 mutation on breast and ovarian cancer risk. Management strategies for confirmed gene carriers in the risk reducing setting and in the therapeutic setting. The relative merits of screening with mammography or MRI, risk reducing mastectomy, oophorectomy and endocrine treatment. The biological function of tumour suppressor genes. The link between BRCA1 and triple negative tumours especially basal phenotype. Li Fraumeni: The effects of carriage of a tp53 mutation on breast and other cancer risk. Management strategies. Ataxia telangiectasia: Heterozygotic female carriers of this autosomal recessive gene are at a 30–68% increased risk of breast cancer. Risk management strategies such as earlier screening. Low penetrance genes: alter breast cancer risk slightly but are not yet routinely tested for, (e.g. CHEK-2, caspase 8). Management of moderate and high-risk women (Surgery vs surveillance vs chemoprevention)
Proliferative lesions	Ductal In Situ Neoplasia Management of Borderline/High risk Lesions	Proliferative benign and precancerous breast lesion management. Effect on breast cancer risk: ductal & lobular in situ neoplasia; ADH, FEA, atypical intraductal epithelial proliferation; radial scar; papillomas; hyperplasia.
Pathology & prognostic factors	Awareness of the two main subtypes: ductal & lobular. Grading systems. Prognostic & predictive factors especially nodal status and receptors (ER, PgR, HER-2).	Aware of all histological sub-types and grades and how they affect treatment and prognosis. Prognostic and predictive factors (ER, HER-2, Ki67). The prognostic value of DNA microarray tests, (e.g. Oncotype Dx or Mammaprint) and their influence on systemic adjuvant treatment & patient outcome. Knowledge of prognostic tools (Nottingham Prognostic Index and Predict online)
Rare types of Breast Malignancies	Fibroepithelial lesions (Phylloides) Sarcomas Lymphomas Secondaries in the breast	Differentiate the management strategies between benign, borderline and Malignant Phylloides Sarcomas (Radiation induced, Genetic syndromes Li-Fraumeni) Breast Implant Associated Anaplastic Large Cell Lymphoma BI-ALCL
Staging and staging methods	TNM Staging. Dissemination patterns: regional nodes, bone, liver, lung, skin, brain. Staging procedures: CT scan, PET scan and Isotope bone scan Indications for staging → basic knowledge or advanced? Differential diagnosis between breast cancer and other metastasis.	Detailed knowledge of the TNM system & effect on prognosis. Dissemination patterns: regional nodes, bone, liver, lung, skin, brain & differences according to breast cancer subtypes. CT scan: Aware that staging for women with high-risk breast cancer should include a CXR or CT of the chest, CT or US of the abdomen and pelvis and isotope bone scan to identify lung, liver and bony metastases. PET Scan: Understand mechanism of action & indications for PET scans. Sensitivity, specificity & factors influencing these. Isotope bone Scan: Isotope bone scan may be required to identify skeletal metastases in patients with breast cancer. How an isotope bone scan works. Differential diagnosis between breast cancer metastasis versus another primary or secondary tumour (lung mass on CT, axillary metastases with no identifiable breast primary). Stage Migration due to improved investigation accuracy.
Diagnosis	Triple assessment with imaging, clinical examination and tissue sampling. The importance of MDT review	Mammography and Tomosynthesis: Indications for it, sensitivity and specificity and factors influencing these, the risks of the procedure. Being able to identify a range of mammographic abnormalities. Ultrasound: Indications for it, how it is performed, its sensitivity and specificity and factors influencing these and the risks of the procedure. MRI: Understanding the indications for breast screening MRI: to identify occult primary cancers, to assess for multifocal disease, lobular cancer or with neoadjuvant chemotherapy. The sensitivity & specificity of MRI & factors influencing these. Biopsy (types and indications): Fine needle aspiration, core biopsy, vacuum assisted biopsy, percutaneous breast lesion excision, open incision or excision biopsy. The importance of MDT concordance and review
Screening	Aware of mammographic screening benefits and risks. Age ranges screened and periodicity.	Aware of the scientific evidence which underpins breast screening and knowledge of the screening trial data. The technique for screening should be understood and the screening interval in their own country. Understanding the controversies surrounding screening (informed consent, over-diagnosis, bias, risks of screening).
Surgical treatment	Indications for mastectomy versus breast conserving surgery. Surgical management of the axilla. Availability and subtypes of reconstruction techniques.	Understand the relative indications & contraindications for mastectomy vs breast conservation. Aware of the different localisation techniques for breast conservation. Understand the surgical management of the axilla. Factors influencing the aesthetic outcome of breast conservation, oncoplastic remodelling techniques in conservative surgery. Understand the difference between level I and Level II Oncoplastic

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	Basic Knowledge	Advanced Knowledge
		Techniques. Ability to describe different volume replacement and volume displacement techniques. Aware of breast symmetrisation surgery (augmentation, reduction, scar revision and lipomodelling) Indications & contraindications for reconstructive techniques. Practical experience of reconstructive surgery including implant based, dermal flap (Inferior Dermal Sling), acellular dermal matrix, TRAM, DIEP, SIEA, TUG, latissimus dorsi, therapeutic mammoplasty, oncoplastics and lipofilling. Complications of surgery. Understanding advantages & disadvantages of axillary surgery in relation to the patient and tumour characteristics. Management strategies for breast disease in older patients
Adjuvant and Neoadjuvant Treatments	Aware of indications for the 4 main types: Endocrine therapy Chemotherapy Radiotherapy Targeted molecular therapies (e.g trastuzumab, pertuzumab etc) Bisphosphonates	Detailed understanding of the types of neoadjuvant and adjuvant therapy, their indications and contraindications, side effects and long-term sequelae. The interaction with surgery- like implant reconstruction and radiotherapy. How age and co-morbidity interact with the indications and benefits of these treatment. The indications of radiotherapy after breast conservation and after mastectomy Knowledge of the key research underpinning current practice.
Locally Advanced	Aware of the criteria for disease to be locally advanced. Able to define what is locally advanced disease. Aware of alternative strategies for management of patients with locally advanced and inoperable disease.	Neoadjuvant treatment strategies. The role of Radiotherapy Surgical techniques: salvage surgery, resurfacing techniques, wound management Symptom control (lymphoedema care for example)
Metastatic	Treatment: may include palliative surgery, chemotherapy, radiotherapy, bisphosphonates, endocrine therapy, trastuzumab, supportive	Understand how to diagnose & manage metastatic disease including palliative surgery for bone metastases, resection of the primary or distant metastases (liver, skin, brain, lung) in patients with small volume disease, chemotherapy & endocrine therapy, uses of palliative radiotherapy, prognostic factors. The role of bisphosphonates. Palliative symptom control. The role of the specialist nurse.
Psycho-oncology Psychosocial and Survivorship issues	Aware of effect of a general cancer diagnosis. Aware of altered body image of loss of the breast	Insight into the psychological impact of a cancer diagnosis, loss of femininity, loss of a breast, sexuality, depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies.
Age adjusted therapies	Understanding how age may impact on treatment choices	Variation in Biology Fertility, pregnancy and contraception Breast Cancer in Pregnancy Genetics Role of Ovarian Suppression
Breast cancer in young women	Imaging limitations and the use of MRI	

2.2. Colorectal Cancer

Geerard Beets.

	Basic Knowledge	Advanced Knowledge
Incidence	Colorectal: worldwide third most common cancer, second most common cause of cancer mortality. Higher incidence high income countries 1: 15 men 1: 19 women **Anal:** rare.	**Colorectal:** Variable incidence rates by country and age. Disease specific mortality trends. Increase in young age, possibly related to obesity. **Anal:** Increasing incidence
Aetiology	**Colorectal:** Age, diet, obesity, chronic inflammation (ulcerative colitis), familial **Anal:** HPV infection. Immuno-suppression. Awareness of	**Colorectal:** Detailed awareness of the relative risk of aetiological factors and mechanism of effect, and the evidence. Understand progression from polyps to malignancy. Malignancy risks of chronic inflammatory disease (ulcerative colitis, Crohn's disease). **Anal:** Risk factors: infection with human papilloma virus 16 and 18, receptive anal intercourse, immunosuppression (HIV, transplant, ageing, etc.). Association with other HPV related diseases: CIN and VIN

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	Basic Knowledge	Advanced Knowledge
	prevention strategy with HPV vaccination.	
Genetics	**Colorectal:** Aware and broad understanding of syndromes and management of FAP and Lynch syndrome/ HNPCC. Importance of obtaining a family history. **Anal:** No familial association.	**Colorectal:** Understanding of the polygenic and single gene alterations and underlying mechanisms in colorectal cancer carcinogenesis. Understanding of sporadic and familial MSI-high/dMMR tumours, and FAP and Lynch/HNPCC syndromes. Knowledge of lifetime risk of carriers, screening options, and pro and con of the different management options, including prophylactic surgery. Broad understanding of extracolonic manifestations, and more rare related syndromes (i.e. mesenteric fibromatosis, Peutz Jeghers syndrome, juvenile polyposis syndrome). Use of anamnestic criteria to identify high risk cases, and options of systematic or selective histological testing of biopsies and specimens for MSI/MMRd.
Pathology	**Colorectal:** Polyps, dysplastic polyps and adenocarcinoma. **Anal:** AIN and anal squamous carcinoma	**Colorectal:** Detailed understanding of the polyp to adeno-carcinoma sequence and key mutations involved in the transition. Awareness of other types of colorectal and appendiceal tumours: mucinous and signet-cell adenocarcinoom, GIST, NET, SCC of rectum, etc … Management and prognosis variation by subtype, stage, location. **Anal:** Anal Intra-epithelial neoplasia, squamous cell carcinoma and its variants (basaloid, mucoepidermoid, cloacogenic), melanoma, small cell carcinoma, adenocarcinoma. Management and prognosis by subtype and stage.
Staging	**Colorectal:** TNM Staging	**Colorectal:** Detailed knowledge of the TNM staging system. Awareness of pre-operative staging investigations including the role of MRI in rectal cancer, staging liver and lungs with pre-operative CT, endorectal ultrasound, endoscopy and biopsy. **Anal:** TNM classification. Prognosis and treatment variation by stage. Staging investigations with physical examination/ EUA, pelvic, abdominal and chest CT, proctosigmoidoscopy and biopsy, inguinal node assessment with ultrasound and use of PET-CT.
Diagnosis	**Colorectal:** Clinical features. Role of endoscopy, biopsy, CT, MRI. **Anal:** Physical examination and proctoscopy, CT/MRI.	**Colorectal:** Clinical signs and symptoms of disease of different stages and different locations in the bowel. Indications for and contraindication to pre-operative tests and their potential risks and limitations (colonoscopic perforation, bleeding). Interpretation of scans for operability and stage of disease. **Anal:** Clinical signs & symptoms, diagnostic & staging work-up. HPV status.
Screening	**Colorectal:** Different screening strategies. Range of screening age. **Anal:** aware of screening in high risk patients. Aware of prevention strategy with HPV vaccination.	**Colorectal:** Scientific evidence and pro and cons of different screening strategies (FOB, endoscopic). Potential health gains. Controversies surrounding screening such as informed consent, types of bias in data and the potential harms of screening. Justification for the range of screening age. **Anal:** screening and surveillance in high risk patients. High resolution anuscopy, dye enhancement endoscopy. Impact of HPV vaccination on incidence of anal cancer.
Surgical treatment	**Colorectal:** Types of resectional surgery according to tumour location and presentation. General indications for neoadjuvant treatment. General principles of nonsurgical organ preservation approaches **Anal:** Treatment primarily non-surgical with surgery for salvage by APR	**Colorectal:** Detailed understanding of surgical anatomy and technical aspects of all colorectal procedures, including minimal invasive techniques. For rectal tumours this includes proper TME techniques, transanal techniques, sphincter preserving techniques, and extralevator techniques. Adequate level of lymphadenectomy for colorectal cancer, and knowledge of lateral nodal dissection. Indications for surgical and nonsurgical options in acute obstructions: resection − deviating stoma − stent. Peri-operative care including knowledge of prehabilitation and fast track protocols. Awareness of special considerations in frail patients and emergency presentations. Detailed understanding of indication and benefits and harms of different neoadjuvant schedules (short course RT, chemoradiation, chemotherapy) for more advanced tumours Understanding of the different organ preservation approaches for rectal cancer, and of the benefits and harms. **Anal:** Stage and type specific treatment protocols. Use of chemoradiotherapy (5-FU and mitomycin C with external beam radiotherapy) and rates of complete response. Aware of key trial data. Indications for surgery: persistent or recurrent disease after chemoradiation. Extralevator rectal amputation technique, groin lymph node dissection and plastic reconstructive techniques. Surgical and non-surgical treatment of Anal Intraepithelial Neoplasia (AIN).
Adjuvant Treatments	**Colorectal:** Aware of the main types of adjuvant treatments, chemotherapy and radiotherapy, and their broad indications. Basic understanding of potential role of immunotherapy in MSI/ dMMR tumours	**Colorectal:** Types of adjuvant therapy, their indications and contraindications, side effects & long-term sequelae. Awareness of regimens (5-fluourouracil, leucovorin, capecitabine, oxaliplatin and key trials). Influence of age and comorbidity on indication. Use of adjuvant radiotherapy for rectal cancer in very selected high-risk cases. Significance of MSI/dMMR in choice for (neo)adjuvant treatment, and potential role of immunotherapy.
Locally advanced cancer	**Colorectal:** Aware of alternative strategies with neoadjuvant therapy to improve resectability	**Colorectal:** Assessment of disease extent on imaging. Understanding of neoadjuvant (chemo)radiation and chemotherapy for rectal and colonic cancer. Indications, schedules and timing. Restaging methods. Extra-anatomical surgical techniques, multivisceral resections. Involvement of other disciplines when required (urology, plastic surgery, bone resection, etc.). Indications and use of intra-operative radiotherapy. Role of palliative surgery (defunctioning stoma, bypass), stents and palliative chemo- and radiotherapy regimes. **Anal:** Appropriate surgical procedures (see surgical treatment), including palliative procedures. Chemoradiation schedules (see surgical treatment).
Metastatic colorectal cancer	**Colorectal:** Aware of potential curability of some patients with metastases. Aware of principles of palliative	**Colorectal:** Understand diagnosis and management of metastatic disease. Palliative surgery for obstruction (resections, bypass, stoma). Role of HPB team in assessment of operability of liver metastases. Role of chemotherapy agents (FOLFOX, FOLFIRI, capecitabine, cetuximab, bevacizumab) and immunotherapy in palliation and conversion to resectability. Role of immunotherapy in MSI/dMMR tumours. Role of interventional procedures in conversion to operability and palliation. Importance of predictive molecular markers or features for systemic therapy (K-RAS for anti-EGFR antibodies, etc.)

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	Basic Knowledge	Advanced Knowledge
	surgery for obstruction, chemotherapy, immunotherapy, radiotherapy, and supportive care.	Symptom control: analgesia & anti-emesis. Palliative rectal radiotherapy. Role of the specialist nurse. End of life care and advanced directives.
Psycho-oncology	Aware of effect of a general cancer diagnosis. Aware of effects of stoma. Principles of shared decision making.	Insight into the psychological impact of a cancer diagnosis, the impact of a stoma, depression and anxiety, the role of the clinical nurse specialist. How to recognise & manage the symptoms and signs of psychological distress and secondary mental illness.

2.3. Thoracic Cancer

Merlijn Hutteman & Jerry Braun.

	Basic Knowledge	Advanced Knowledge
Incidence	**Lung:** Most common cause of cancer death in the Western World. Second most common cancer. **Thymoma:** uncommon, but most neoplasm in anterior mediastinum Mesothelioma uncommon: 1% of all cancers	**Lung:** Detailed knowledge of age specific incidence rates and variations in rates internationally. Understanding of link to past smoking trends in the population and the threat of future smoking epidemics in 3rd world countries whose smoking habits have still not peaked. In western world, incidence of smoking is decreasing, increase of lung cancer in never-smokers. **Pleural:** Mesothelioma is rare, (1% of all cancers). Aware of the increasing incidence of mesothelioma and the trends with a peak expected in 2020 followed by a subsequent decline due to the long latency related to asbestos exposure **Thymoma:** rare, 0.13 per 100,000 person years, often incidentaloma on scans (CT/MRI)
Aetiology	Cigarettes smoking, air pollution, asbestos	**Lung:** Link between smoking and lung cancer and the 30-40-year latency. Effect of metaboliser status as a genetic modifier of risk. Passive smoking. Air pollution as primary risk factor in never-smokers. Link with asbestos, coal and other forms of mining. Occupational lung disease: cadmium, arsenic, uranium and terpenes. **Pleural:** Specific link between mesothelioma and asbestos and very long latency (20 years). **Thymoma:** relation to myasthenia gravis (15% of MG patients have thymoma, 35% of thymoma patients suffer from MG)
Genetics	Genetic predisposition of minor significance in most cases.	**Lung:** Cytochrome P450 metaboliser status and risk of lung cancer in smokers. Li Fraumeni syndrome (inherited p53 mutation) and lung cancer risk. Germline mutations (EGFR, HER2) in limited number of families with high rates of lung cancer.
Pathology	Small cell lung cancer (SCLC) and non-small cell lung cancer (NSCLC).	**Lung:** Detailed understanding of the 2 main histological subtypes, SCLC and NSCLC. Understanding of the subtypes of NSCLC (adeno − including in situ, squamous, and large cell types) and SCLC (carcinoid spectrum/Kulchitsky classification). Clinical, pathological and treatment differences. **Thymoma:** Understanding of WHO classification (A, AB, B1-3, C − thymic carcinoma) **Pleural:** Detailed understanding of the range of histological appearances of mesothelioma (epithelial, sarcomatoid and mixed).
Staging	TNM Staging (NSCLC). SCLC: limited disease (LD) and extensive disease (ED)	**Lung:** Detailed knowledge of the TNM staging for both SCLC and NSCLC and how each stage relates to prognosis and treatment. Aware of the requirements for staging of SCLC (CT chest/abdomen, MRI brain, bone scan when no PET-CT was made and NSCLC (CT chest and upper abdomen, PET CT scan, depending on iTNM: EBUS, mediastinoscopy, MRI brain). **Thymoma:** CT, Masaoka-staging, MRI when indicated **Pleural:** Detailed knowledge of the TNM classification and how to stage the disease (CT) **Metastatic:** Aware of the common malignancies that present with lung metastases: how this impacts on prognosis and stage.
Diagnosis	Aware of presenting clinical symptoms and signs. Diagnostic tests including CXR, CT scan, MRI, PET scan. Bronchoscopy, EBUS, Mediastinoscopy	**Lung:** Aware of the wide range of presenting symptoms and signs including rarer manifestations: paraneoplastic syndromes, Pancoast's syndrome, SVC obstruction, recurrent laryngeal, phrenic and vagal nerve involvement). Understands indications for different diagnostic and staging tests, including the indications for different types of biopsies, (transthorcic, open, transbronchial/endo(echo)scopic biopsy) use of CT and PET scans. Able to interpret the resectability/operability and stage of a cancer based on the imaging appearances. Pleural: Aware of the often vague symptoms of mesothelioma, especially in its early stages, importance of history of asbestos exposure. **Thymoma:** aware of symptoms pointing to myasthenia gravis. Chest CT for diagnosis, sometimes MRI to determine cardiac/vascular involvement. Differentiation with other anterior mediastinal tumours (lymphoma, germ cell tumours)
Screening	Aware of screening strategies currently under investigation but that none are yet in routine clinical use	**Lung:** Aware of the evidence base of trials for lung cancer screening including CXR, CT and immunologically based blood tests. Can argue for and against screening in terms of the risk to benefit ratio and cost effectiveness. Aware of landmark trials (e.g. NELSON trial) and specific subgroups for whom screening could be advantageous. **Metastases:** Aware of the use of surveillance for certain types of malignancy for lung metastases (sarcoma, colorectal).
Surgical treatment	Types of resectional surgery according to tumour location, type and presentation	**Lung:** Aware that SCLC is usually disseminated at presentation and is treated primarily by systemic chemotherapy (+/− radiotherapy) with rare early stage disease (peripheral T1 or 2, N0) treated surgically. The indications for and contraindications to different surgical procedures for NSCLC (anatomic resection: segmentectomy, lobectomy, pneumonectomy, open resection, Video Assisted Thoracoscopic Surgery (VATS), RATS, indications for nodal surgery and staging, mediastinal node dissections, extended resections). Induction therapy in case of Pancoast tumours. Pre-operative preparation of the patient for surgery including functional assessment (spirometry, ergometry). Post- operative care and complications of surgery. Use of lung radiotherapy in patients with poor performance status instead of surgery.

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	Basic Knowledge	Advanced Knowledge
		Pleural: Indications for surgery for mesothelioma: palliative chemotherapy, surgical options (extrapleural pneumonectomy or pleurectomy/decortication) within trials. Pre-operative preparation, technical aspects of surgery and aftercare. Complications **Metastatic:** Indications for and contra-indications to metastasectomy. Pre-operative preparation, technical aspects of surgery and aftercare.
Pathological assessment	Methods of assessing pre-treatment biopsies and resected specimens	**Ha**ematoxylin/eosin staining, immunohistochemistry, molecular analysis (next-gen sequencing) including analysis for targetable mutations such as ALK/EGFR, PDL-1 status.) Awareness of basic reporting guidelines for pathological reports: T-stage, nodal assessment, pleural involvement, radicality of resection.
Adjuvant Treatments	Aware of the main types of adjuvant treatments (chemotherapy radiotherapy, immunotherapy) and their broad indications. Neoadjuvant treatment strategies (targeted/ TKI, chemotherapy, radiotherapy, immunotherapy)	**Lung:** NSCLC: Detailed understanding of the types of adjuvant therapy, their indications and contraindications, side effects and long-term sequelae. How age and co-morbidity interact with the indications and benefits of these treatment. Knowledge of the key research that underpins current practice. Types of chemotherapy used. Cisplatin based regimes, erlotinib and the emerging role of molecular markers to direct therapies: ALK and EGFR targeting. Role of immunotherapy (PDL-1), currently in stage IV, expanding indications. SCLC: in the uncommon case of a single early stage peripheral nodule suitable for surgery, adjuvant chemotherapy ± radiotherapy may be given post-operatively. **Pleural** Role of chemotherapy in trials
Locally advanced	Use of chemotherapy and radiotherapy for palliation	Lung: Palliative chemotherapy and radiotherapy for both SCLC and NSCLC. Symptom control measures. Use of neoadjuvant chemotherapy in some locally advanced NSCLC (I.e. Pancoast): response rates, agents in use, indications and contraindications. Pleural: Role of and efficacy of palliative chemotherapy and radiotherapy. Emerging new agents: pemextred + cisplatin in advanced mesothelioma
Metastatic disease	Use of chemotherapy and radiotherapy for palliation	Lung: NSCLC: Use of chemotherapy and palliative radiotherapy SCLC: Aware of EGFR mutational status. Patients with EGFR mutations benefit from antiEGFR tyrosine kinase inhibitors. Patients with ALK positivity should be treated with ALK inhibitors. Aware that chemotherapy may achieve complete response although 5-year survival rates are poor. Regimens based in platinum derivatives and taxanes are commonly used, often in addition to RT to the lung. Role of PDL-1 targeted therapy as standard of care in case of metastatic NSCLC without targetable mutation and its effect on progression free survival and overall survival.
Psycho- oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a lung cancer diagnosis, the impact of guilt in smokers, depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies.

2.4. Upper Gastro-intestinal Cancer (Oesophageal, Gastric, GIST, Small Bowel)

Marco Fiore, Domenico D'Ugo & Jelle Ruurda.

	Basic Knowledge	Advanced Knowledge
Incidence	**Oesophageal:** 1 in 60 male, 1:120 females **Gastric:** similar to above **GISTs and small bowel:** extremely rare	**Oesophageal:** Males 3x as likely to develop as females. Rates of SCC are static, rates of adenocarcinoma are increasing rapidly. **Gastric:** Rates falling generally apart from cancer of the gastric cardia which is increasing slightly. Wide variation in rates globally with highest in East Asia. **Small bowel:** Very rare. Carcinoids increasing. **GIST:** Very rare
Aetiology	**Oesophageal:** Barrett's metaplasia, smoking, alcohol, acid reflux, obesity, male sex and diet. **Gastric:** smoking, autoimmune gastritis, alcohol and helicobacter	**Oesophageal**: Aetiology differs by histological type. SCC: smoking, alcohol, caustic stricture, Plummer Vinson syndrome, Tylosis (both rare), radiotherapy. Adenocarcinoma: obesity, Barrett's esophagus & reflux disease (bile reflux in particular). **Gastric:** Link to deprivation, smoking, helicobacter, atrophic gastritis, diet, male gender. 10% familial link (hereditary diffuse gastric cancer, p53, BRCA2, Peutz Jeghers & HNPCC). Aware of the link of MALToma with helicobacter infection.
Genetics	**Gastric:** Hereditary diffuse gastric cancer syndrome as rare cause of early onset gastric cancer	**Oesophageal:** Awareness of the possible hereditary component of risk in Barrett's mucosa associated oesophageal cancer. **Gastric:** Understanding of hereditary diffuse gastric cancer syndrome (CDH1 mutation, multi-centricity) and link to breast cancer and how this is managed (prophylactic gastrectomy), p53 & BRCA2, Peutz Jeghers & HNPCC mutations increase risk. **GIST:** Aware of the acquired mutations underlying GISTs in the kit and PDGFR genes and how these affect disease biology and drug sensitivity to imatinib and sunitinib; aware of the familial conditions associated with GIST (Carney triad, Carney syndrome, NF1)
Pathology	**Oesophageal:** 2 main types: adeno and squamous. **Gastric:** Mainly adenocarcinoma.	**Oesophageal:** Two main types: squamous & adenocarcinoma. Awareness of differing locations, aetiology, mode of spread & infiltration of the esophagus, different treatment regimes.

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	Basic Knowledge	Advanced Knowledge
	Gastric lymphoma rare **GIST:** Rare.	**Gastric:** Aware 95% are adenocarcinoma with 2 subtypes according to the Lauren classification: intestinal & diffuse or 4 subtypes by the WHO (tubular, mucinous, signet ring & papillary. Aware of the different presentations & patterns of local infiltration. Aware of mucosa associated lymphoid tissue (MALToma) associated lymphoma & its link to Helicobacter. **Small bowel:** Adenocarcinoma, carcinoids, lymphomas **GIST:** Aware of the classifications of GISTs in terms of level of malignancy and prognosis. Role of mutational analysis in GIST.
Staging	Broad understanding of TNM Staging. Basic understanding of the methods for staging and prognostic implications	**Oesophageal:** Knowledge of the TNM system for staging. Prognosis & treatment selection according to stage of disease. **Gastric:** TNM classification. TNM & Lugano for MALToma's. **Small bowel:** TNM classification for adenocarcinoma and neuroendocrine tumours. Ann Arbor system for lymphomas. **GIST:** Understanding of other classification systems such as the Mittinen and Joensuu classifications for GIST.
Diagnosis	Aware of presenting clinical symptoms and signs. Diagnostic tests including CT scan, endoscopy and biopsy, transluminal ultrasound.	**Oesophageal:** Aware of presenting clinical symptoms and signs. The indications for and limitations of different investigations to stage include CT, PET-CT, Endoscopic Ultrasound, thoracoscopy and laparoscopy. Able to interpret the operability and stage of a cancer based on the CT scan or EUS appearances. Need for upper aerodigestive tract examination in squamous cell cancer. **Gastric:** Aware of symptoms & signs including those of metastatic disease. Indications for & limitations of CT scans, EUS, endoscopy & biopsy. Role for laparoscopy prior to laparotomy. Awareness of different diagnostic criteria in Asia vs western world. **Small bowel:** Aware of symptoms & signs, including systemic features of carcinoid syndrome. Pre-operative assessment with barium studies, endoscopic techniques, videocapsule, push-pull enteroscopy, CT scan, serum chromogranin A & MIBG scans (neuroendocrine). **GIST:** Aware of symptoms & signs. Pre-operative assessment with CT scan, endoscopy & biopsy ± PET scan. Role of preoperative biopsy **All:** Able to interpret operability & stage based on imaging.
Screening	Aware of screening strategies currently in use in some countries	**Gastric:** Understanding the different types of screening that are used for gastric cancer & the arguments for & against them in the West. Aware of screening techniques in some countries such as Japan & Chile & how disease & population factors specific to this population justify screening.
Surgical treatment	Types of resectional surgery according to tumour location and presentation Aware of role of neoadjuvant therapies in broad terms.	**Oesophageal:** The indications for and contraindications to different surgical procedures: endoscopic mucosal resection, submucosal dissection, subtotal and total esophagectomy, (transhiatal, transthoracic or 3 stage), esophagogastrectomy, Merendino procedure. Indications and contraindications for laparoscopic resection and nodal clearance. Techniques of reconstruction (incl. colonic interposition). Possible indications for and regimes for neoadjuvant chemoradiotherapy. Pre, peri and post-operative care. Management of complications. Nutritional support (e.g. PEG, TPN). **Gastric:** Indications for endoscopic mucosal resection, submucosal dissection, Indications and technical expertise in esophagogastrostomy, total gastrectomy, distal gastrectomy. En-bloc lymphadenectomy, D1-3. The debate relating to splenectomy. Laparoscopic versus open resection. Pre, peri and post-operative care. Nutritional support. Special case of MALToma's and role of helicobacter eradication, radiotherapy and the very rare need for surgery. Management of complications, management of perforated gastric cancer. **Small Bowel:** Indications for pancreaticoduodenectomy (duodenal adenocarcinoma), segmental bowel (duodenal) resections. Technical expertise. Pre, peri and post op. care. **GISTs:** As above depending on site. Aware of meaning and significance of resection margins and tumour rupture.
Multimodal Treatments	Aware of the main types of adjuvant treatments (chemotherapy and radiotherapy) and their broad indications	**Oesophageal and Gastric:** Detailed understanding of the concepts of (neo-) adjuvant therapy, their potential benefits and hazards, contraindications, side effects and long-term sequelae. How age and co-morbidity limit the application and potential benefit of these treatments. Be aware of the concept of definitive chemoradiotherapy. Critically discuss the key research in multimodality therapy. **GISTs:** The risk stratification tools used to guide therapy and indications for use of adjuvant tyrosine kinase inhibitors. Use of neoadjuvant therapy with imatinib to downsize locally advanced/high-risk or unresectable disease.
Incurable Disease: Locally advanced	Aware of strategies for palliative management of patients with locally unresectable disease.	**Oesophageal:** Palliative chemotherapy and radiotherapy. Symptom control. Palliative treatments such as stenting, PDT, dilatation, laser ablation, brachytherapy, PEG. Emergency strategies for bleeding, perforated or obstructing tumours. **Gastric**: indications for stenting and bypass surgery. Rationale of palliative chemotherapy. Consider the importance of determining HER2 status. HER2 +++ could benefit from the addition of Trastuzumab to chemotherapy.
Metastatic	General palliation of symptoms.	**Gastric and oesophageal:** Common metastatic sites for each cancer and how these are managed. Palliative control of pain, anorexia, nausea and nutritional support. Palliative surgery (resectional/bypass/stenting/laser ablation/cytoreductive surgery and HIPEC) **Small bowel:** Management of neuroendocrine liver metastases (resection, transplantation, RFA, embolization), medical management of carcinoid syndrome, (octreotide, newer agents: lanreotide, interferon, targeted therapies, radio-

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	Basic Knowledge	Advanced Knowledge
		pharmaceuticals). **GISTs:** Palliative imatinib, sunitinib, regorafenib. Response monitoring by CHOI's response criteria (PET, CT), use of mutational profiles in response prediction.
Psycho-oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a cancer diagnosis, depression, aggression and anxiety. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Socioeconomic implications of malignant disease. Management strategies.

2.5. Hepatopancreatobiliary Cancer

Cristina Dopazo & Kjetil Soreide.

	Basic Knowledge	Advanced Knowledge
Incidence	Broad knowledge of the incidence of this group of cancers in Europe and globally.	**Colorectal liver metastases:** Overall age standardised & age-related incidence in the general population & in population with colorectal cancer. Trends in Europe & underlying causal factors. Pancreatic cancer: Overall incidence & age variance in Europe. Trends in Europe. Disease specific mortality. **Hepatocellular carcinoma:** Overall incidence & age variance in Europe. Global incidence rates & trends & links to rates of hepatitis B & C, fatty liver disease & alcohol. Disease specific mortality. Geographical distribution **Cholangiocarcinoma and gallbladder cancer:** Overall incidence and age variance in Europe. Trend in Europe. Disease specific mortality. Ethnic variations.
Aetiology	Aware of the major risk factors for each cancer type.	**Colorectal liver metastases:** Risk factors for development. Pancreatic cancer: Chronic pancreatitis, hereditary predisposition, smoking, obesity, diabetes, diet rich in meat and low in fruit and vegetables. **Hepatocellular carcinoma:** Alcohol, Hep B and C, NAFLD, cirrhosis, haemochromatosis, Wilson's disease, alpha -1-antitrypsin deficiency, aflatoxin. **Cholangiocarcinoma and gallbladder cancer:** Linked to sclerosing cholangitis, Clonorchis sinensis, nitrosamine, chronic liver disease, choledochal cysts, gallstone disease & chronic cholecystitis.
Genetics	Aware of difficulties in screening for malignant disease in primary HPB cancer	**Pancreatic cancer:** Association of familial cancer syndromes with increased risk of pancreatic cancer (BRCA2, Lynch syndrome, MEN1 & others). Familial Pancreatic Cancer (gene not known) **Colorectal liver metastases:** hereditary polyposis colorectal cancer syndrome, Lynch syndrome **Hepatocellular carcinoma:** Haemochromatosis, Wilson's disease, alpha -1-antitrypsin deficiency **Cholangiocarcinoma:** Lynch syndrome, Caroli's disease.
Pathology		**Colorectal liver metastases:** Mechanisms of spread to the liver & other distant sites. Metastasis angiogenesis. Morphological characteristics of both primary tumour and metastases that indicate better prognoses after liver resection. Molecular pathology and biomarkers (RAS, BRAF, MSI) **Pancreatic cancer:** Subclassification of ductal, acinar and islet (neuroendocrine); genetic subgroups (3–4 suggested) with therapeutic implications; IPMN derived cancers **Hepatocellular carcinoma:** Understanding of the aetiological role of cirrhosis/fibrosis. Three panel biomarker (HSP70 (HSPA7), glypican 3 (GPC3), and glutamine synthetase (GS) and cytokeratin 19 as poor prognosis **Cholangiocarcinoma & gallbladder cancer:** link to aetiological factors, extracellular vesicles as biomarkers.
Staging	Broad understanding of the TNM classification systems for each cancer Type	**Colorectal metastases:** TNM, Fong score, GAME score, Tumor Burden Score; change in score validity over time **Pancreatic cancer:** TNM **Hepatocellular carcinoma:** TNM, Okuda, Cancer of the Liver Italian Program (CLIP), Japanese Integrated Staging (JIS) Score and the Barcelona Clinic Liver Cancer (BCLC) system, French Classification, The Hong-Kong Liver Cancer staging system (HKLC), The Chinese University Prognostic Index (CUPI) **Cholangiocarcinoma and gallbladder cancer:** TNM, Bismuth classification, Memorial Sloan-Kettering Cancer Centre classification
Diagnosis	Understanding of the indications for and limitations of ultrasound, CT and MRI in pre-operative assessment. Importance of specialist MDT review before biopsy is undertaken.	**Liver lesions:** The role of CT, MRI, US & PET scanning in pre- operative workup. The role of gadoxetic acid-enhanced MRI and contrast enhanced ultrasound. The role & significance of Ca 19.9 and CEA, liver function & coagulation tests & alpha feto protein measurement at both diagnosis & monitoring of treatment. Indications & contraindications to percutaneous biopsy.

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	Basic Knowledge	Advanced Knowledge
		Pancreatic lesions: The role of CT, MRI, US & PET scanning in pre-operative workup. ERCP and biopsy. The role of, indications and contraindications for percutaneous biopsy. Definition of borderline, locally advanced and metastatic. Use of biomarkers CA 19-9 (non-producers, responders etc.) **Biliary lesions:** Ca 19-9, CT, MRI, Ultrasound and PET scanning in pre-operative workup. ERCP and biopsy. Role of PTC. The role of laparoscopy. Indications and contraindications for percutaneous biopsy. **For all cancer types:** Understanding of the clinical symptoms and signs of the disease. Ability to interpret MRI and CT scans for diagnostic and operability decision making.
Screening	Screening for HCC in Cirrhosis	**Hepatocellular carcinoma:** Understanding of the arguments for screening for HCC in cirrhosis, the ideal interval for surveillance and the role of ultrasound. **PDAC:** Discuss the arguments for (currently) NOT recommending pancreatic cancer screening. Understanding pre-diagnostic risk factors, e.g. pre-diabetes, glucose intolerance etc
Surgical treatment	Colorectal specialists should have a detailed knowledge of the treatment and assessment for colorectal liver metastases. All other specialist areas should be broadly aware of the range of techniques used for surgery of HPB cancers but not their precise indications or contraindications.	**Colorectal liver metastases:** Indications and contraindications for metastasectomy/hemihepatectomy/extended hepatectomy, ablation, portal embolization or multimodal therapies. Indications for ALLPs or two-stage procedures, advantages or disadvantages of each. Indications for neoadjuvant therapy. Indications for simultaneous procedure, reverse or conventional approach in synchronous disease. Paper of liver transplant. **Pancreatic cancer:** Different types of pancreatic resections (distal pancreatectomy, Whipple's procedure, pylorus preserving pancreatico-duodenectomy, total pancreatectomy). Techniques for reducing pancreatic fistulae formation and its post-operative treatment. Palliative bypass procedures. Hepatocellular carcinoma: Indications and contraindications for resection, ablation and liver transplantation. Regarding BCLC staging system for tumours within Milan Criteria. Indication of liver transplantation for tumours without Milan Criteria. Role of down-staging. **Cholangiocarcinoma and gallbladder cancer:** - Defining resectability of hilar cholangiocarcinoma: indications for preop biliary drainage (endoscopy or PTC), role of preoperative portal embolization, hepatectomy required following Bismuth classification, non-touch technique, ALPPS, role of liver transplantation - Defining resectability of intrahepatic cholangiocarcinoma in cirrhotic and non-cirrhotic liver, role of liver transplantation. - Defining resectability of GB cancer relationship to stage. Type of liver resection that should be performed. Management of the incidental GB cancer found at Laparoscopic Cholecystectomy **For all cancers:** Detailed understanding of pre-operative preparation, peri and post-operative care. Liver resection: 1. Types of liver resection - Nomenclature of liver resections (Brisbane system) - Laparoscopic, laparoscopic-assisted, open laparotomy - Nonanatomic, segmental, lobectomy, extended lobectomy - Vascular control: none, Pringle manoeuvre, total vascular isolation - Vascular resection and reconstruction - Staged resections - Combination with ablation 2. Preoperative assessment and the cumulative risks to the proposed procedure - Patient comorbidities (cardiopulmonary and other) - Hepatic risk (a) Assessment of liver function, portal hypertension (b) Volumetric assessment of liver remnant (c) use of Portal vein embolization – or similar strategies 3. Preoperative management - Prophylaxis against common complications: DVT, infection - Detailed operative plan based on preoperative imaging 4. Liver resection – Anaesthetic considerations - Agents, coagulation, CVP - Blood loss conservation including cell saver and blood product administration - Laparoscopic technique: Patient and port placemen, Hand port - Parenchymal transection techniques (a) Relative advantages and disadvantages (b) Normal, fatty, fibrotic and cirrhotic parenchyma

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	Basic Knowledge	Advanced Knowledge
		(c) Laparoscopic or open use - Concomitant resection and reconstruction of the (a) Diaphragm (b) IVC (c) Portal vein (d) Bile duct 5. Postoperative management - Complications and management, including liver failure and bile leakage. Grading of severity by the International Study Group of Liver Surgery. Understanding of the intra-operative techniques specific to HPB surgery (low CVP anaesthesia, CUSA and other dissection aids, coagulation aids, argon beam coagulation).
Adjuvant Treatments		**Colorectal metastases:** Evidence of neoadjuvant and adjuvant treatments. Indications for doublet or triplet therapy and targeted therapy. Role of biomarkers. Conversion therapy approach in patients with liver limited disease based in last trials (CELIM, GONO, POCHER, OLIVIA)for systemic and regional therapies for hepatectomy **Pancreatic cancer:** Knowledge of the data (or lack of) to support adjuvant therapies. **Hepatocellular carcinoma:** Knowledge of the data (or lack of) to support adjuvant therapies. of the neoadjuvant treatments in the waiting list or to improve rates of resection (TACE, radioembolization and external radiation). Role of the support adjuvant therapies (Sorafenib, lenvatinib, regorafenib, cabozantinib) **Cholangiocarcinoma and gallbladder cancer:** Knowledge of the data (or lack of) to support adjuvant therapies of neoadjuvant therapies and adjuvant therapies, studies going on (NACRAC study, BILCAP trial, Prodige-11 trial)
Locally advanced and metastatic cancer	Aware of the impact of liver metastases and how they should be treated with reference to their own disease site and how to identify other pathologies which may require more specialist treatments. Aware of the broad range of therapies on offer (surgery, systemic chemotherapy, stenting, targeted arterial infusions, bypass surgery, RFA) but not the precise indications or contraindications.	**Colorectal metastases:** Understanding the role radiofrequency ablation or cryoablation, microwave ablation, brachytherapy electroporation, external body radiotherapy with high-precision RT, radioembolization, chemoembolization, hepatic arterial infusion. Indication and risk of ablative treatment. Palliative chemotherapy. **Hepatocellular carcinoma**: Indications and contraindications should be understood. **Cholangiocarcinoma:** Systemic chemotherapy, hepatic arterial infusion, chemoembolization, radioembolization. Stenting for palliation of obstructive jaundice. **Metastatic GISTs:** Role of imatinib in the palliative setting. Treatment response assessment with CT and PET. **Other noncolorectal liver metastasis:** Understand the role of resection compared to other modalities in a biology/survival benefit-risk setting.
Psycho-oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a cancer diagnosis, depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies.

2.6. Skin Cancer and Melanoma

Jos van der Hage & Viren Bahadoer.

	Basic Knowledge	Advanced Knowledge
Incidence	Incidence increasing in Western countries	Aware of the rising incidence in Western countries and worldwide at a rate of approximately 5% per year. In the United States and Canada, melanoma has increased at a rate exceeding that of any other tumour except lung cancer in women. This increase is multi- factorial: Sun exposure, skin texture, changing of dress code and travelling. Australia and the United States have two of the highest incidence rates of melanoma in the world.
Aetiology	Ultraviolet light	They should be able to discuss ultraviolet light exposure as etiological factor and other risk factors: heritable predisposition, dysplastic nevus syndrome, history of skin cancer, associated with sun exposure and Xeroderma pigmentosum.
Genetics		Dysplastic nevus syndrome, Xeroderma pigmentosum FAMMM, p16 mutation (CDKN2A).
Pathology	Melanoma classification by depth and link to prognosis. Recognise common subtypes.	**Melanoma subtypes:** histologic growth patterns: Superficial Spreading Melanoma, Nodular Melanoma, Acral lentiginous Melanoma, Lentigo Malignant Melanoma. Prognostic factors for primary melanoma: Depth of invasion, Ulceration, Regression, Mitotic rate. **Mucosal Melanoma**: Aware of their existence, genetic differences from skin melanoma (c-kit mutation) treatment and prognosis
Staging	General principles of TNM staging.	Melanoma TNM classification and the clinical and pathological staging of melanoma according to AJCC (8th edition)
Diagnosis	Morphological signs that make a pigmented	**Morphological signs** that make a pigmented lesion suspicious for Melanoma (ABCD for asymmetry, border irregularity, colour variation. diameter)

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	Basic Knowledge	Advanced Knowledge
	lesion suspicious for Melanoma (ABCD for asymmetry, border irregularity, colour variation, diameter)	Aware of the benefits of Dermoscopy Proper biopsy technique (excision vs. incision) and non-proper technique (shaving) **Physical exam for melanoma** **Imaging Studies** **PET-CT scan** Aware that standard staging for stage III + melanoma should include a PET-CT and MRI scan of the brain. This includes use to confirm or identify the presence of metastatic
Screening	Aware of mole mapping and pre-test risk stratifications in high risk populations	Aware of high-risk groups amenable for screening (FAMMM, P16 mutation carriers)
Surgical treatment	Wide excision and the importance of adequate margins. SLNB and nodal clearance.	**Primary lesion:** wide local re-excision for stage I and II melanoma and the results of the clinical trials of melanoma excision margins. Timing of wide excision and anatomical directions **Sentinel Node Biopsy:** Indications, contraindications complications, technique of imaging prior to surgery, results of multi centre studies, pathology work up, completion lymph nodes dissection. **Treatment of clinical lymph node metastasis:** Indications and surgical technique of radical axillary dissection, groin dissection: superficial and deep Iliac, neck dissection.
Adjuvant Treatments	Aware of use of interferons check point inhibitors and targeted therapies	**Adjuvant systemic therapy:** Anti PD-1, CTLA-4 inhibition, BRAF-MEK inhibition, Interferon alpha -2b high dose, pegylated form: indications, contraindications, regimes, side effects. **Adjuvant radiotherapy:** Indications
Locally advanced	Aware of use of ILP, TVEC, CO2 laser ablation, electrochemotherapy and adjuvant therapies (see adjuvant treatments)	**Treatment of in transit metastasis:** Awareness of isolated limb perfusion & be able to describe the technique, its indications, contraindications and complications Awareness of topical treatments like CO2 laser, TVEC, electrochemotherapy Indications for adjuvant systemic therapy
Metastatic		**Radiological work up and classification.** **Medical treatment:** Aware of the different modalities. **Chemotherapy:** DTIC **Immunotherapy:** Check point inhibitors Interlukin-2, Chemo-immunotherapy, adoptive cellular therapy, anti −CTLA-4 monoclonal antibody (ipilimumab) and BRAF and MEK inhibitors
Psycho-oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a cancer diagnosis, the depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies.

2.7. Urological Malignancies

Theo de Reijke.

	Basic Knowledge	Advanced Knowledge
Incidence	**Bladder cancer:** Common **Renal cell carcinoma:** Uncommon **Prostate cancer:** Very common **Testicular Cancer:** Rare **Penile Cancer:** Very rare	**Bladder cancer:** 2.5% of men and just under 1% of women. Rates decreasing due to reductions in smoking and occupational carcinogen exposure. **Renal cell carcinoma:** 1.5% of men and 1% of women. Rates increasing possibly due to incidental detection on cross sectional imaging and link to obesity **Prostate cancer:** 11% of males. Percentage affected is roughly equal to man's age after age 50. Massive increase in incidence may reflect increased detection with PSA testing but mortality is largely static. Incidence linked to affluence (availability of PSA testing). **Testicular Cancer:** Rare. Incidence rising. **Penile Cancer:** Very rare, higher incidence in Eastern countries
Aetiology	**Bladder cancer:** Main causes smoking and chemical carcinogens **Renal cell carcinoma:** Smoking and obesity **Prostate cancer:** Age Testicular Cancer: Cryptorchidism, familial risk, hormones. **Penile Cancer:** HPV infection.	**Bladder cancer:** Smoking, chemical carcinogens, radiation exposure, familial risk, schistosomiasis, infections. **Renal cell carcinoma:** Smoking, obesity, familial risk, acquired cystic disease. **Prostate cancer:** Age, familial risk. **Testicular Cancer:** Linked to cryptorchidism and infertility. Probable hereditary factor yet unidentified. **Penile Cancer:** HPV infection (esp. types 16 and 18). Links to smoking, immunosuppression. Circumcision seems protective.
Genetics	**Renal, prostate & bladder cancer:** Have a familial association. **Testicular:** Likely hereditary factor, not yet identified. **Penile:** Familial association	**Prostate cancer:** Linkage with the BRCA1/2 mutation in male carriers. All two types are more common in cases with affected family members due to polygenic factors. **Testicular cancer:** Gene (s) not yet identified. Definite familial risk for relatives of patients with the disease **Penile cancer:** More likely in relatives of affected individuals
Pathology	Aware of common types.	**Bladder cancer:** Urothelial carcinoma (most common), squamous, adenocarcinoma, micropapillary and small cell type **Renal cell carcinoma:** Clear cell, papillary, chromophobe, oncocytic, Bellini/collecting duct. Rarely in children: Wilm's tumour.

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	Basic Knowledge	Advanced Knowledge
		Prostate cancer: Adenocarcinoma (small cell rare) **Testicular Cancer:** 2 main types: seminoma and non-seminoma (choriocarcinoma, embryonal, yolk-sac and teratoma). Sometimes metastatic lesions e.g. lymphoma. Aware of frequency and age specific incidence and presentational variance. **Penile Cancer:** 90% squamous, rarely adenocarcinoma, melanoma or basal cell carcinoma.
Staging	Aware of use of TNM for all types but not detailed classification.	**Bladder cancer:** TNM staging system. **Renal cell carcinoma:** TNM staging system. **Prostate cancer:** TNM staging system. **Testicular:** TNM staging system, IGCCCG prognostic grouping classification in metastatic disease (good, intermediate and poor) **Penile:** TNM staging system (which includes tumour grade) Prognosis and treatment variations according to stage of disease for all types. Aware of risk groups and how these groups are defined.
Diagnosis	Broad understanding of investigative work up for each type of cancer and symptoms and signs of clinical presentation.	**Bladder cancer:** Aware of the presenting symptoms and signs. Flexible cysto-urethroscopy, urine cytology, CT scanning/MRI scanning. Role of TURBT, random biopsies Able to interpret scans for tumour stage and operability. **Renal cell carcinoma:** Aware of the presenting symptoms and signs including significant number of asymptomatic cases detected on scans incidentally. Paraneoplastic symptoms. Diagnostic tests: CT (and MRI) scan of abdomen and chest to look for evidence of lung metastases. Bone scan to stage for bone metastases if indicated. Role of biopsy for small renal masses, also in case of exclusion of metastatic lesions. Able to interpret scans for tumour stage (including renal vein and IVC involvement) and operability, is aware of role of nuclear imaging **Prostate cancer:** Aware of the presenting symptoms and signs and fact that most cancers are asymptomatic (PSA detected tumours). Diagnostic tests: biopsy, MRI, and TRUS. Able to interpret scans for operability and stage (PSMA scans). **Testicular Cancer:** Role of US, CT scan to stage for nodal and lung metastases. Serum alpha-fetoprotein, beta-HCG and LDH as prognostic factor to be determined pre-operatively. Aware that biopsy is contraindicated if surgical cure is contemplated. Is aware of counselling for semen preservation **Penile Cancer:** Biopsy, nodal staging with US and FNA. MRI for more locally extensive disease. Is aware of sentinel node procedures
Screening	**Prostate cancer**: Aware of controversy over pros and cons of screening with PSA.	**Prostate cancer:** Detailed understanding of the screening trials with PSA and the controversy about the risks (overtreatment), benefits and cost effectiveness of screening. No effective screening for the other types of cancer
Surgical treatment	**Bladder cancer:** Aware of a range of treatment options from non-surgical, minimally invasive to radical and broad indications. **Renal cell carcinoma:** Nephrectomy, and renal sparing procedures **Prostate cancer:** Aware of range of options from active surveillance, prostate sparing to radical surgery/ radiotherapy and broad indications for each. **Testicular:** Inguinal orchidectomy plus or minus retroperitoneal node surgery. **Penile:** Aware of range of options from locally ablative to radical surgery.	**Bladder cancer:** Indications for TURBT plus adjuvant, chemotherapy instillations, BCG instillation, radical cystectomy, radiotherapy plus chemotherapy. Detailed technical understanding of the procedure for cystectomy, lymphadenectomy and different forms of urinary diversions. Pre-operative preparation and post-operative complications of surgery. Renal cell carcinoma: Surgical partial or radical nephrectomy. Different surgical approaches and techniques, including laparoscopic and robotic surgery. Surgical techniques in case of extensive tumour process e.g. cava thrombus, metastatic lesions. Prostate cancer: Indications for active surveillance, focussed therapy modalities, radiotherapy (external or brachytherapy) or surgery. Technical aspects of radical prostatectomy including different techniques (laparoscopic, robotic, open, lymphadenectomy). Understands pre-operative preparation and post-operative complications and their management. Salvage procedures. Testicular Cancer: Radical Inguinal orchidectomy. For seminomas and non-seminomatous tumours, role of, indications for and controversy surrounding use of retroperitoneal lymph node dissection. Role of chemotherapy and salvage procedures. Penile Cancer: Indications for and operative technique for circumcision, locally ablative therapies (laser, cryotherapy), wide excision, glansectomy, partial and complete penectomy. Reconstructive options. Indications for and technique for groin nodal dissection and sentinel node biopsy.
Adjuvant Treatments	**Bladder cancer:** **Renal cell carcinoma:** None **Prostate cancer:** Radiotherapy and endocrine therapy. **Testicular:** Broad awareness that radiotherapy and chemotherapy used depending on stage and type. **Penile:** None	**Bladder cancer:** (Neo-) adjuvant chemotherapy in case of muscle invasive bladder cancer. Role and place of checkpoint inhibitors **Renal cell carcinoma:** None (discussion on pre- and post-targeted therapy e.g. Sutent/checkpoint inhibitors or combinations) **Prostate cancer:** Indications for radiotherapy and endocrine deprivation therapy, especially in combination with radiotherapy. **Testicular cancer:** Indications for and extent of radiotherapy to the retroperitoneal nodes. Indications for active surveillance and adjuvant carboplatin. Difference in seminoma and non- seminoma. Chemotherapy may be curative for most advanced germ cell tumours. **Penile Cancer**: None
Locally advanced		**Bladder cancer:** surgery, radiotherapy plus chemotherapy, chemotherapy. Renal cell carcinoma: surgery, targeted therapy/immunotherapy **Prostate cancer:** surgery plus lymph node dissection, radiotherapy ± endocrine therapy, endocrine therapies alone (androgen receptor blockers, orchidectomy, LHRH analogues or antagonist), watchful waiting, chemotherapy (taxane based) radiotherapy (external beam, IMRT or brachytherapy). **Testicular:** Indications for neo-adjuvant chemotherapy, response rates and regimes. Indications for and risk of post neoadjuvant

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	Basic Knowledge	Advanced Knowledge
		chemotherapy retroperitoneal node dissection. **Penile:** Indications for radiotherapy
Metastatic	**Renal cell carcinoma:** aware of emergence of targeted therapies. **Prostate cancer:** Endocrine therapies. **Testicular:** May still be cured with chemo- and radiotherapy and surgery.	**Bladder cancer:** Chemotherapy or checkpoint inhibitors **Renal cell carcinoma:** Potential role for chemotherapy (IL2 and newer biological agents: e.g. Sunitinib, sorafenib, everolimus, temsirolimus and bevacizumab) new place for checkpoint inhibitors (ipilimumab/nivolumab and cabozantinib). **Prostate cancer:** Role of endocrine therapies: GNRH agonists/antagonist, orchidectomy, chemotherapy (docetaxel, cabazitaxel), androgen receptor blockers (abiraterone, enzalutamide), apalutamide, Radium-223, Lutetium bisphosphonates, RT to metastatic bone disease. Combination therapy in low volume disease (radiotherapy to primary plus androgen deprivation therapy). Treatment of oligometastatic disease. **Testicular:** Chemotherapy, radiotherapy and surgery may all be appropriate and long-term cure achieved. **Penile Cancer:** Indications for and types of chemotherapy and chemoradiotherapy for palliation
Psycho-oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a cancer diagnosis, the depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies. Fertility issues associated with testicular cancer and strategies to preserve fertility. Cosmetic issues with testicular cancer and availability of testicular implants. Psychological and sexual issues with prostate, penile and testicular cancers.

2.8. Endocrine Malignancies (thyroid, parathyroid, adrenal and pancreatic endocrine all NETS)

Menno Vriens & Tessa van Ginhoven

	Basic Knowledge	Advanced Knowledge
Incidence	**Thyroid:** Uncommon nature of thyroid cancer and gender and age specific differences. **Parathyroid:** Predilection of female gender, rarity of cancer. **Adrenal:** Rarity of cancer and frequent occurrence of incidental lesions. **Neuroendocrine tumours:** (pancreas, liver, GI and bronchus): uncommon	**Thyroid:** 1 in 240 for women. 1 in 650 for men. Rates vary across Europe and globally. Rate is increasing (up to 3-fold in last 30 years) – largely due to increased detection of 'dormant' incidental tumours. Worldwide difference in diagnostic approach of thyroid incidentalomas. Less diagnostics in i.e. The Netherlands. **Parathyroid:** Female: male ratio: 4:1 for benign adenomas/hyperplasia. Sex ratio equal for carcinomas **Adrenal:** Adrenal cortical carcinoma very rare (1/million/yrs.). Metastatic adrenal cancer common (lung, gastric and breast primaries). Functional adrenal adenomas (pheochromocytoma, steroid secreting) usually benign and all uncommon. **Neuroendocrine tumours:** arising from tissues of foregut, midgut and hindgut origin. Increasing diagnosis with widespread use of cross-sectional imaging and endoscopy.
Aetiology	**Radiation:** exposure may predispose to thyroid cancer and primary hyperparathyroidism. **Genetic:** Several genetic syndromes underlie a number of patients with multiple endocrine tumours (especially MEN1 and 2).	Understanding of the link between radiation and thyroid and parathyroid disease. Understanding of the clinical phenotypes associated with MEN1, MEN2A and MEN2B syndromes (can affect a number of endocrine glands including pituitary, thyroid, parathyroid, adrenal and neuroendocrine cells of the gastrointestinal and respiratory tract).
Genetics	Awareness of MEN1 and MEN2 syndromes and the existence of non- MEN familial endocrine disease.	**Thyroid:** pathogenesis linked to BRAF kinase activation, the ras oncogene, PAX8-PPARG and the RET proto-oncogenes. Familial links to MENS 2A and B, FAP, Cowden's and familial Medullary Thyroid Cancer Syndrome. **Parathyroid:** MEN1, MEN2A familial isolated primary hyperparathyroidism (FIPHPT) and Hyperparathyroidism-Jaw tumour syndrome (HPT-JT). **Adrenal:** Adrenal cortical tumours are often sporadic but may be associated with MEN1, Li Fraumeni and Beckwith-Wiedeman syndromes. Similarly, pheochromocytomas may be a component of MEN 2A, MEN 2B, neurofibromatosis type I, von- Hippel Lindau and hereditary paraganglioma syndromes **Neuroendocrine**: Mostly sporadic. Small number linked to Wermer syndrome (MEN1). Should have detailed understanding of MEN syndromes and underlying genetic abnormality and how to manage it.
Pathology	**Thyroid:** Aware of different types of differentiated thyroid cancer, medullary thyroid cancer, poorly differentiated/ anaplastic cancer and lymphoma and broad differences in behavior **Parathyroid:** Benign adenomas common, carcinomas very rare	**Thyroid:** Predominantly papillary (80%), but others include follicular (10%), Hurthle cell (3%), medullary (5%), anaplastic (2%) and miscellaneous (1%). Aware of the different subtypes in each category and prognostic and therapeutic significance of different subtypes. **Parathyroid:** Understand the therapeutic significance of single gland (85%) and multigland disease (15%) and the rarity of parathyroid cancers (<1%). **Adrenal:** Detailed understanding of cortical and medullary pathology. Understanding of the difficulty in differentiating between benign and malignant tumours histologically. **Neuroendocrine tumours:** Functioning (insulinoma, gastrinoma, glucagonoma, VIPoma, somatostatinoma etc.) and non-functioning subtypes. Understanding of the differences in malignant potential of various subtypes.

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	Basic Knowledge	Advanced Knowledge
	Adrenal: cortical and medullary – benign (functional and non-functional) and malignant lesions **Neuroendocrine:** Awareness of different sites of origin and differences in behavior of well and poorly differentiated subtypes.	
Staging	**Thyroid:** Understand the staging system, especially the importance of age and gender. Awareness of generally excellent prognosis of most **Parathyroid:** Is a biochemical diagnosis. If malignancy is suspected perform neck-US. **Adrenal:** CT scan for local situation. When ACC is suspect, check for distant metastasis prior to surgery. **Neuroendocrine:** Consider functional PET-CT's.	**Thyroid:** TNM system and other staging systems (such as AMES, AGES and MACIS). Impact of subtype on prognosis. Awareness of the controversy around lymph node involvement in prognosis of differentiated thyroid cancer. Role of calcitonin levels in predicting prognosis in Medullary Thyroid Cancer. **Parathyroid:** No currently accepted staging system. Aware of prognostic factors. **Adrenal:** TNM system, Weiss score for cortical neoplasms, and PASS score for phochromocytoma. **Neuroendocrine:** TNM system, importance of histologic grade and the differences in staging systems depending on site of tumor. WHO NET grading
Diagnosis	**Ultrasound, FNA, Parathyroid** Biochemical diagnosis **Adrenal** Assessment of both functional and possible malignant features. **Neuroendocrine:** differences in behaviour of well and poorly differentiated subtypes.	**Thyroid:** Awareness of symptoms and signs of thyroid lumps and thyroid dysfunction. Understanding of the role of thyroid function tests, ultrasound and other cross-sectional imaging, radionuclide imaging and biopsy (usually FNA, rarely core biopsy). **Parathyroid:** Awareness of symptoms and signs of hypercalcemia and differential diagnosis of hypercalcemia. Palpable lumps are very rare and increase likelihood of cancer. Role of imaging in pre-operative localisation: US, Technetium sestamibi scans, single photon emission CT, MRI and 4D-CT. **Adrenal:** Detailed understanding of biochemical workup for cortisol, aldosterone and sex-hormone excess for cortical tumours and catecholamines and metanephrines for medullary tumours. Presentation may be with features of hormonal excess or incidental, although local symptoms may occur in locally invasive malignant tumours. Understanding of the role of cross-sectional imaging such as CT/MRI, functional imaging such as MIBG and venous sampling in instances such as Conn's syndrome. **Neuroendocrine:** Aware of symptoms of functioning tumours and local symptoms of non-functioning tumours. Aware of incidental presentations and postoperative histological diagnoses (such as appendiceal neuroendocrine tumours). Role of cross-sectional imaging (Ultrasound, EUS, CT, MRI), functional imaging (such as 68-GA dotatoc/tate imaging) and biochemical assessment
Screening and prevention	Possible in certain familial syndromes and high-risk families.	Understanding of need for screening in index patients, family members and carriers of specific mutations. Examples include MEN1, MEN2A, MEN2B and paraganglioma syndromes. Awareness of need for multidisciplinary input and the involvement of other endocrine glands in patients presenting with one endocrine problem.
Surgical treatment	**Thyroid:** Types of thyroidectomy and indication for nodal surgery. **Parathyroid:** Aware of different approaches to parathyroidectomy. **Adrenal:** Awareness of open and laparoscopic approaches via the anterior, lateral and posterior aspects. Awareness of need for adequate preoperative biochemical assessment and preparation. **Neuroendocrine:** depends on site of tumour	**Thyroid:** Ability to debate about the extent of thyroidectomy, (only lobectomy, total, subtotal, bilateral) in different situations and the underpinning evidence. Detailed understanding of neck anatomy. Understanding complications of surgery and effective means of prevention and treatment. Role of prophylactic and therapeutic central and lateral neck dissection in thyroid cancer. Understand the role of mediastinal lymphadenectomy in certain situations. Understanding the role of innovative approaches (e.g. robot assisted/TOETVA). **Parathyroid:** Role of preoperative localisation techniques (such as US, and Sestamibi and (PET) CT scans) and intraoperative adjuvants (IOPTH, frozen section, radio-guidance, Blue fluorescence) in predicting single gland disease and determining operative strategy. Detailed understanding of targeted/focussed approaches and unilateral/bilateral explorations and the decision making underlying these approaches and the use of appropriate adjuncts. Recognition of carcinoma in the rare instance and the appropriate management (i.e. need for en bloc resection ± thyroidectomy ± lymph node dissection). Knowledge of secondary and tertiary hyperparathyroidism and treatment approaches (Cinacalcet vs surgery) **Adrenal**: Detailed understanding of pre- and peri-operative management of adrenal tumours and the importance of multidisciplinary input. Understanding of the decision-making regarding operability in cancer. Understanding of the operative approach depending on disease characteristics, patient features, expected pathology and local experience. Understanding the role of cortical sparing or subtotal resections. **Neuro endocrine:** Understanding the role of multi-disciplinary input for adequate preoperative preparation and disease localisation (for example in functioning pancreatic neuroendocrine tumours). Understanding the need for intraoperative localisation techniques (such as Ultrasound and EUS). Understanding the role of innovative (e.g. robot assisted) approaches

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	Basic Knowledge	Advanced Knowledge
Adjuvant treatments	**Thyroid:** Role of radio iodine and TSH suppression in differentiated thyroid cancer. **Parathyroid:** none **Adrenal and neuroendocrine:** Endocrine therapy and radio-nuclide treatment in certain situations	**Thyroid:** Aware of uses and indications/contraindications for radioactive iodine and TSH suppression in differentiated thyroid cancer. Knowledge about RAI and rTSh or withdrawal. Understanding the long-term risks of TSH suppression. Role of external beam radiotherapy in certain incompletely resected cancers (anaplastic, medullary etc.) **Parathyroid:** none. **Adrenal and neuroendocrine:** Understand the role of endocrine therapy and radio-nuclide treatment in certain specific situations where risk of recurrence is high. Understanding the role of resecting the primary tumour in a metastasized setting in specific cases For several tumours, an understanding of monitoring for recurrence by biochemical means (using tumour markers) and functional imaging is important. Understanding the role of (radio)embolization in liver dominant disease.
Locally advanced	**Thyroid:** Role of radioiodine ablation, TSH suppression and external beam radiotherapy **Parathyroid:** Role of en bloc resection, radiotherapy **Adrenal and neuroendocrine:** see metastatic disease section	**Thyroid:** Usual stage of presentation of anaplastic carcinoma. Role of radioiodine, TSH suppression in differentiated thyroid cancer Role of external beam radiotherapy in locally advanced cancer of all types Role of targeted molecular therapies such as tyrosine kinase inhibitors and **Parathyroid:** Role of and risks of radical surgery in recurrent and locally advanced disease. Role of external radiotherapy and potential for unproven treatments such as cinacalcet and active Vitamin D. **Adrenal and neuroendocrine:** see metastatic disease section
Metastatic	**Thyroid:** Role of radioiodine ablation, TSH suppression and potential for new biological therapies. **Parathyroid:** Medical treatment of hypercalcemia **Adrenal and neuroendocrine:** Role of endocrine and molecular therapies	**Thyroid:** Role of radioiodine and TSH suppression in differentiated thyroid cancer Role of external beam radiotherapy for symptomatic relief Targeted molecular therapies (Tyrosine Kinase Inhibitors and monoclonal antibodies) for certain subtypes. **Parathyroid:** Medical control of hypercalcaemia, (using a variety of agents including loop diuretics, bisphosphonates, cinacalcet etc.). **Adrenal and Neuroendocrine:** Understanding of endocrine treatments (such as alpha blockade in malignant pheochromocytoma) and therapeutic radionuclide treatments (such as radiolabelled Octreotide treatment of neuroendocrine cancers). Role of combination chemotherapy in adrenal cancers and poorly differentiated neuroendocrine tumours. Role of targeted molecular therapies such as sunitinib. Role of radiotherapy for bone metastases. Selective use of surgical metastatectomy in advanced disease.
Psycho-oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a cancer diagnosis, the depression and anxiety, the role of the clinical nurse specialist. Psychological impact of thyroid dysfunction. Psychological impact of neck scars and voice changes due to recurrent laryngeal nerve palsy. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies. Impact of endocrine dysfunction on mental health (e.g. steroid psychosis, hyper and hypothyroidism, hypercalcaemia etc).

2.9. Sarcoma

Sergio Sandrucci, Jos van der Hage & Marco Fiore.

	Basic Knowledge	Advanced Knowledge
Incidence	Very rare tumours. 1% of all malignancies. Can be subdivided in bone sarcoma and soft tissue sarcoma.	Group of diverse rare malignancies of mesenchymal tissue origin. 1% of all cancers in Western countries. Two age peaks: childhood and young adult (Ewing's family tumours, Rhabdomyosarcomas, Osteosarcomas) and elderly (all other subtypes, named adult-type sarcoma). Awareness of most common subtypes (liposarcomas, leiomyosarcomas, etc), of the broad range of types and their parent tissue. Anatomical sites of common sub-type.
Aetiology	Usually sporadic. Radiation induced. Rarely hereditary (p53)	Mostly sporadic. Radiotherapy may induce late sarcomas after 7–15 years e.g. breast angiosarcoma after breast radiotherapy, pelvic osteosarcoma after prostate/cervical radiotherapy. Link with chronic lymphoedema, (Stewart Treves syndrome: lymphangiosarcoma in chronic lymphoedema), vinyl chloride, thoratrast. Rare genetic syndromes, (p53, RB).
Genetics	Rarely caused by the p53 gene mutation	Rare genetic syndromes may be linked to sarcomas. P53 mutation carriers (Li-Fraumeni syndrome) at increased risk of childhood sarcomas and breast cancer as well as numerous other cancer types. Neurofibromatosis and malignant peripheral nerve sheath tumour and GISTs, FAP/HNPCC and desmoid or fibromatosis of the mesentery. Germline mutation of the retinoblastoma (RB) gene predisposes to sarcoma development.
Pathology	Complex. Multiple subtypes. Aware of a few common types	Familiarity with the major types and their biological behaviour and therapeutic strategies. Aware of the complexities of pathological classification, grading and immunohistochemistry and genetic analysis for specific mutations such as different exon mutations in the c-kit gene in GISTs, the EWS mutation in Ewing's, a reciprocal translocation between chromosomes 18 and X in synovial sarcoma, translocation in chromosomes 8 and 22 in myxoid liposarcoma. Important differential diagnoses. Aware of behavioural characteristics of different types: e.g. high metastatic potential of certain types (Ewing's, angiosarcoma, osteosarcoma, rhabdomyosarcoma, leiomyosarcoma) and low/no metastatic potential of others (dermatofibrosarcoma, desmoids, low grade liposarcomas). Grading determined by cellularity, differentiation, pleomorphism, necrosis and mitotic count (EU: FNCLCC grade; or US: NCI system).
Staging	Depends on size, grade, depth and presence of Metastatic disease	Familiarity with the UICC/AJCC classification and the different prognosis attached to each stage. Aware of specific prognostic classification systems used for GISTs (Miettinen or Joensuu). Aware of specific nomograms for extremity soft tissue sarcoma and retroperitoneal sarcoma, more specific than TNM stages.

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	Basic Knowledge	Advanced Knowledge
Diagnosis	Clinical signs and symptoms of the disease. Tests including MRI, biopsy, US, CT scanning.	Indications for pre-operative investigations such as MRI, US, PET, CT, CXR, bone scan. Skill in interpretation of scans for operability and stage of disease. Indications for different types of biopsy. Principles of biopsy techniques and placement. Image guided biopsy of specific tumour areas.
Screening	None	None
Surgical treatment	Types of surgery according to tumour location and presentation. Wide surgery for bone and soft tissue extremity sarcoma. Extended multivisceral en bloc resection for primary retroperitoneal sarcoma. Peculiar principles of GIST's surgical treatment according to site, size and presentation	Detailed understanding of the relative indications and contraindications for resectional surgery, detailed technique discussion. Limb conservation versus amputation. Awareness of the role and consequences of neoadjuvant RT in 'usual' tumour types. Special tumour types that are treated with induction chemotherapy (Ewing's, Osteosarcoma, rhabdomyosarcoma) or primarily by medical therapies (HAART therapy/doxorubicin in HIV associated Kaposi's sarcoma). The importance of obtaining clear resection margins and how margins are classified (marginal, intralesional, wide, radical, compartmental) – evaluation of excision margins (quantitative and qualitative). Amputation types and their indications and techniques (forequarter, above-below elbow, hemi-pelvectomy, hip disarticulation, below knee). Wound closure techniques (flaps, grafts etc). Endoprosthetic replacement for primary bone sarcomas. Pre-operative preparation and post-operative care and complications (seromas, wound breakdown, phantom limb pain). Limb prostheses and rehabilitation. Specific considerations about anatomic implication of truncal tumours. Principles of surgery for primary retroperitoneal sarcomas (RPS): definition of anatomical region, principles of extended en bloc multiorgan resection, indication for vascular resection/replacement as well as for major en bloc procedures (Whipple, liver resection; treatment principles of recurrent RPS. Specific considerations for resection of primary GISTs.
Adjuvant treatment	Aware of the use of radiotherapy in the pre-operative or post-operative setting. Benefit of chemotherapy in high-risk presentations and specific subtypes. Imatinib for GISTs.	**Molecular Therapies:** Criteria for adjuvant imatinib in GISTs. Mechanism of action of imatinib. Mutational analysis in prediction of tumour response. **Radiotherapy:** Indications and contraindications, post-surgical resection of high-risk sarcomas. Short- and long-term complications of RT. Use of highly targeted RT with intensity modulated CT image guided RT (IMRT). No benefit of RT in retroperitoneal sarcoma. **Chemotherapy:** Aware of trials of adjuvant/neoadjuvant chemotherapy showing limited value in most sarcoma. Evidence of some benefit in high risk selected patients: Anthracyclin + Ifosfamide regimen is superior to histology-driven approaches.
Locally advanced	Aware of alternative strategies for management of patients with inoperable disease or local recurrence.	**Surgery:** Indications for amputation (limb sparing surgery not possible, recurrent disease, palliation). Appropriate consideration for neoadjuvant therapy to permit limb salvage **Radiotherapy:** Use of external beam RT in the palliative or neoadjuvant setting. Indications for IMRT or more targeted techniques such as proton therapy in certain highly critical areas (skull base or paraspinal tumours). **Chemotherapy:** Induction chemotherapy in Ewing's, osteosarcoma, rhabdomyosarcoma Neoadjuvant chemotherapy may be active in neoadjuvant setting for cytoreduction, even though efficacy is not definitely established. Preoperative chemotherapy can be safely combined with concomitant radiation therapy. **Molecular Therapies:** Use of neoadjuvant imatinib (Tyrosine Kinase Inhibitor, TKI) in GIST. Assessment of response with CT and PET scanning. Use of sunitinib (TKI) as second line therapy and use of mutational signatures to predict response to TKIs **Isolated limb perfusion:** Indications and contra-indications and how it is administered. Complications.
Adjuvant treatment	Aware of the use of radiotherapy in the pre-operative or post-operative setting. Benefit of chemotherapy in high-risk presentations and specific subtypes. Imatinib for GISTs.	**Molecular Therapies:** Criteria for adjuvant imatinib in GISTs. Mechanism of action of imatinib. Mutational analysis in prediction of tumour response. **Radiotherapy:** Indications and contraindications, post-surgical resection of high-risk sarcomas. Short- and long-term complications of RT. Use of highly targeted RT with intensity modulated CT image guided RT (IMRT). No benefit of RT in retroperitoneal sarcoma. **Chemotherapy:** Aware of trials of adjuvant/neoadjuvant chemotherapy showing limited value in most sarcoma. Evidence of some benefit in high risk selected patients: Anthracyclin + Ifosfamide regimen is superior to histology-driven approaches.
Psycho-oncology	Aware of effect of a general cancer diagnosis.	Insight into the psychological impact of a cancer diagnosis, the depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies. Aware of the impact of a cancer diagnosis on children, teenagers and young adults and how to support.

2.10. Gynaecological Malignancies

Ane Gerda Zahl Eriksson, & Elisabeth Berge Nilsen.

	Basic Knowledge	Advanced Knowledge
Incidence	All uncommon	**Cervical:** 1 in 134 women lifetime risk. Rates falling due to screening in most age groups but increasing in younger women. Geographically highest risk in LMICs **Endometrial:** 1 in 46. Rates increasing, mainly due to increased obesity rates. Disease of first world countries. Ovarian: 1 in 54. Rates falling due to widespread use of the oral contraceptive (OCP). **Vaginal/Vulvar:** Rare, but on the rise. Others: Sarcoma, Gestational trophoblastic disease all rare
Aetiology	**Cervical** HPV **Endometrial:** Obesity **Ovarian:** Sporadic, Genetic	**Cervical:** Sexually transmitted. HPV virus subtypes 16 and 18 linked to development of CIN and cervical cancer. Link to sexual activity, especially at early age, multiple sexual partners & smoking. **Endometrial:** Linked to obesity and unopposed oestrogen. Tamoxifen. Nulliparity, early menarche, later menopause. Diabetes. **Ovarian:** Familial risk. Protective effect of OCP. **Vaginal/vulvar:** Older age, HPV infection **Other:** Gestational trophoblastic disease linked to pregnancy. Uterine sarcomas may occur secondary to pelvic radiotherapy.

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	Basic Knowledge	Advanced Knowledge
Genetics	**Ovarian:** Aware of link between BRCA1 and 2 **Endometrial:** HNPCC	**Ovarian:** Aware of the BRCA1 and 2 genes and a detailed understanding of the level of increased risk and how it should be managed. Able to discuss the ovarian cancer screening trials and the impact of prophylactic salpingo-oophorectomy. **Endometrial:** 5% of endometrial cancers are hereditary, predominantly linked to HNPCC
Pathology	**Cervical:** Squamous (~80%) **Endometrial:** Adeno (~80%) **Ovarian:** Epithelial (~80%)	**Cervical:** Squamous. **Endometrial:** endometroid adenocarcinoma ~80%, non-endometrioid (papillary, serous or clear cell) ~20%. Molecular classification of EC is gaining evidence and support, incorporated in 2020 ESGO guidelines. **Ovarian:** Epithelial (multiple subtypes, most common is high-grade serous carcinoma). Germ cell tumours, sex cord stromal tumours, Mullerian less common. **Vaginal/vulvar:** Majority squamous **Others:** Sarcoma: multiple subtypes including leiomyosarcoma, endometrial stromal sarcoma, adenosarcoma. Gestational trophoblastic disease: hydatidiform mole and malignant gestational trophoblastic disease. **For all**: awareness of different presentations, risk factors and treatment by pathological type.
Staging	Aware of the FIGO system but not precise staging for each cancer. (International Federation of Gynecology and Obstetrics)	**Cervical:** FIGO staging system (2018). **Endometrial:** FIGO staging system (2009). **Ovarian:** FIGO staging system (2013). **Vaginal/vulvar:** FIGO staging system (2009). **For all:** Awareness of the staging classification, prognostic implications, treatment options by stage.
Diagnosis	Role of physical examination, biopsy if appropriate and cross sectional imaging.	**Cervical:** Pelvic examination, biopsy, cystoscopy, proctoscopy, IVP, pelvic CT and MRI for tumor extent, CT for metastasis. **Endometrial:** Pelvic examination, biopsy/curettage, IVP, CT scan and MRI. **Ovarian:** Pelvic examination, transvaginal ultrasound, biopsy if metastatic disease. CT for metastasis. **Vulvar:** Pelvic examination, biopsy, MRI for pelvic involvement, CT for metastasis. **Ovarian:** CT scan, Ca 125, pelvic and rectal examination. **Vaginal/vulvar:** Pelvic examination, biopsy, (depending on extent: cystoscopy, proctoscopy, CT scan and MRI. **For all**: Ability to interpret relevant scans for stage and operability.
Screening and prevention	**Cervical:** Pap smear screening. Recent introduction of HPV vaccination to prevent cervical cancer	**Cervical:** Detailed understanding of the Pap smear cytology test, the age range and the fact that the disease may be detected at a pre-invasive stage. Costs and potential harms of screening. Impact of HPV vaccination programme to prevent cancers. **Ovarian:** Targeted screening for high familial risk. Lack of evidence for ovarian cancer screening. Able to discuss the current and previous screening trials and their results and implications.
Surgical treatment	**Cervical:** Radical hysterectomy **Endometrial:** Hysterectomy, BSO and nodal evaluation **Ovarian** Cytoreductive surgery	**Cervical:** Depending on stage varies from simple to radical hysterectomy + pelvic nodal dissection. Should be aware of fertility sparing approach such as simple cervical cone and trachelectomy with sentinel node biopsy or pelvic nodal dissection. Radiotherapy with chemotherapy an alternative if surgery not possible. **Endometrial:** Early stage: hysterectomy and BSO ± pelvic nodal dissection + omentectomy in non-endometrioid. **Ovarian:** Commonly presents at advanced stage requiring cytoreductive surgery involving all 4 quadrants. Goal is no visible macroscopic disease or <1 cm residual. If this is not feasible neoadjuvant chemotherapy should be offered. The role of HIPEC in ovarian cancer is currently being explored in clinical trials. If no macroscopic involvement beyond ovaries/fallopian tubes: TAH, BSO, peritoneal cytology and biopsies, omentectomy and pelvic + paraaortic nodal dissection. In select cases fertility sparing can be discussed with gynaecologic oncologist. **Vulvar:** Wide local excision + SLN or groin node dissection, radical vulvectomy, +/− radiotherapy depending on stage.
Adjuvant treatments	**Cervical**: None or **Radiotherapy Endometrial:** None or chemotherapy/ radiotherapy **Ovarian:** Chemotherapy	**Cervical:** Indications for adjuvant chemo-radiotherapy **Endometrial:** Indications for post-operative radiotherapy, chemotherapy. **Ovarian:** Post cytoreductive surgery adjuvant chemotherapy with platinum and taxane based regimes. **Vaginal/vulvar:** Radiotherapy
Locally advanced cancer	**Cervical:** radiotherapy **Endometrial:** radiotherapy **Ovarian:** Chemotherapy	Cervical: Radiotherapy: external and brachytherapy with weekly chemotherapy with curative intent. Neoadjuvant treatment is rare. Endometrial: Depending on histology and extent of disease. Neoadjuvant chemotherapy can be considered. Radiotherapy as palliative treatment. Ovarian: Role for neoadjuvant chemotherapy prior to cytoreductive surgery. Role for intraperitoneal chemotherapy in optimally debulked patients. Vaginal/vulvar: Role of radiotherapy
Metastatic cancer	**Cervical:** Chemotherapy **Endometrial:** Chemotherapy, anti- estrogens **Ovarian:** Chemotherapy **Others:**	**Cervical:** Palliative chemotherapy (platinum-based regimes). Radiotherapy may be indicated for symptom control. **Endometrial:** Chemotherapy, anti-oestrogens, progestins. **Ovarian:** Role for neoadjuvant chemotherapy prior to cytoreductive surgery. Role for intraperitoneal chemotherapy in optimally debulked patients. Vaginal/vulvar: Palliative chemotherapy or radiotherapy for local control or to palliate metastatic disease (for instance bone metastases)
Pschyo-oncology	Aware of effect of a general cancer diagnosis. Aware of psychological significance of the loss of fertility/femininity	Insight into the psychological impact of a cancer diagnosis, the impact of loss of reproductive organs on fertility and feeling of feminity and sexuality, depression and anxiety, the role of the clinical nurse specialist. How to recognise the symptoms and signs of psychological distress and secondary mental illness. Management strategies.

2.11. Peritoneal Surface Malignancies

Andreas Brandl, Beate Rau & Santiago Gonzales-Moreno.

	Basic Knowledge	Advanced Knowledge
Incidence	**GI cancer:** 10–15% at diagnosis, 50% in recurrences after radical surgery. **Other causes:** Rare	**Pseudomyxoma peritonei:** 1–2 cases per million-year, 1% of all colorectal malignancies **Desmoplastic small round cell tumour (DSRCT):** Very rare **Primary peritoneal neoplasms:** Rare **Mesothelioma:** 25% of all mesotheliomas.0.5–3 cases per million-year. Slowly rising incidence in Europe (latency after asbestos exposure in 20th century).
Aetiology	**Secondary "peritoneal metastasis":** From gastrointestinal or gynaecologic malignancies, including sarcoma and GIST. **Primary peritoneal:** possible link to asbestos	**DSRCT:** Unknown origin **Pseudomyxoma Peritonei (PMP):** Appendiceal origin in vast majority. Definition and proper use of the term "PMP" **Pathogenesis** of the peritoneal dissemination process: - Natural history of peritoneal free cancer cells (clinical and molecular level) - Lesions' distribution pattern ("redistribution phenomenon") - Contribution of surgical tumour manipulation (tumour cell entrapment hypothesis) **Primary peritoneal neoplasms:** asbestos exposure identified in less than 25% of cases of mesothelioma.
Genetics	No genetic background known to date	**DSRCT** carries typical mutation in EWS (diagnostic)
Pathology	Aware of wide range of primary pathologies in secondary cases (gastric, appendiceal, ovarian etc).	**Pathology as a key prognostic factor** (appendix, mesothelioma, signet ring features) - **Mesothelioma:** diffuse malignant (epithelioid, sarcomatoid, biphasic), low-grade (well-differentiated papillary, multicystic) - **Appendix:** epithelial (intestinal vs mucinous), carcinoid, adenocarcinoid - **Colorectal:** intestinal vs mucinous, signet ring cell, BRAF - **Gastric:** Lauren types, HER2, ki-67, signet ring cell - **Ovarian:** serous, mucinous, endometrioid, clear cell - **Appendiceal mucinous neoplasms:** nomenclature of primary lesion and peritoneal implant histopathology Primary peritoneal neoplasms: mesothelioma, papillary serous carcinoma, primary peritoneal adenocarcinoma Aware of **discordant cases** (peritoneal implant and primary tumour pathological appearance differ)
Staging	**Stage IV** disease by definition (peritoneal metastasis)	No standard staging system for primary peritoneal neoplasms. **Peritoneal Cancer Index** (PCI) as a measure of tumour burden PCI validated as a key prognostic factor in all peritoneal surface malignancies (primary or secondary). Newly proposed staging system for diffuse malignant peritoneal mesothelioma (PCI, N, M)
Diagnosis	**Clinical** (History and Physical exam) **Imaging** (CT) **Laparoscopy** **Biopsy-** necessary to prove peritoneal malignant disease needed before treatment planning	Aware of limitations and indications of each imaging modality (CT, diffusion weighted MRI, PET/CT) in the diagnosis and assessment of disease extent. Recognizes direct and indirect imaging signs of peritoneal dissemination. Knowledgeable of expected sites of disease Aware of need for expert pathologist Pathological differential diagnosis of Diffuse Malignant Peritoneal Mesothelioma (immunohistochemistry)
Screening and prevention	Aware of proper surgical handling of primary tumours (including appendiceal mucocele) in order to avoid peritoneal tumour spillage.	Aware of ongoing trials and studies on the prophylactic use of HIPEC in high risk scenarios. Aware of indications and implications of systematic second- look surgery for early diagnosis of peritoneal dissemination. Identify primary lesions or scenarios at high risk for developing subsequent peritoneal dissemination: appendiceal mucocele locally advanced, node positive primary colon and gastric cancer Positive peritoneal cytology - Resected limited peritoneal carcinomatosis - Ovarian involvement Intraoperative rupture of a tumour mass
Surgical treatment	Broad indications and patient selection for radical treatment: Cytoreductive surgery combined with Hyperthermic Intraperitoneal chemotherapy (HIPEC) Aware of nearest specialist centre for opinion & treatment Indications for palliative surgery	**Cytoreductive surgery:** Highly complex technical procedure. Aware of the indications and contra-indications. Able to interpret imaging for potential resectability. Understanding of how to perform the surgical procedure with detailed understanding of the anatomy. Pre, peri and post-operative care. Aware of stop signs. Learning curve. **HIPEC:** detailed understanding of its indications and contraindications, techniques for use, available technology, different agents in use, their dosing and their pros and cons and side effects. Aware of possible occupational hazards and proper handling of chemotherapy in the Operating Room.
HIPEC	Aware of use of intraperitoneal chemotherapy as an adjunct to cytoreductive surgery.	**Perioperative intraperitoneal chemotherapy:** - HIPEC - EPIC (early postoperative intraperitoneal chemotherapy) **Postoperative adjuvant bidirectional chemotherapy** through an i.p. port (ovarian, mesothelioma) **Neoadjuvant bidirectional chemotherapy** (NIPS) in gastric cancer Systemic therapy: Indications, efficacy, choice of drugs/biologicals and timing in relation to surgery (induction, adjuvant)
Metastatic cancer	N/A	**Simultaneous peritoneal and liver metastases:** Indications and patient selection for radical treatment (colorectal cancer)
Psycho-oncology	Emotional impact of diagnosis. Dealing with initial discouraging prognosis.	Impact on self and family of prolonged hospitalization. Reinforce coping strategies. Crucial role of proper information for patient to understand a complex treatment

3.0. Generic Clinical Skills

Sergio Sandrucci.

Domaine	Required Skills
Clinical Diagnostic Skills	Recognise signs and symptoms of cancer both in their own specialist areas and generally.
Radiology Interpretation	Interpretation of CT, MRI, PET, mammography etc. and other scanning modalities such that disease can be recognised, stage assessed, operability assessed, and other diagnostic modalities suggested to complement assessment. The limitations and indications for each imaging modality should be understood.
Pre-operative Assessment	Thorough understanding of how to assess a patient for suitability for surgery and anaesthesia including appropriate tests and their interpretation. Understanding of the impact of age and co-morbid diseases on fitness for surgery and how treatment may be modified to accommodate co-morbid diseases. Aware of alternative anaesthetic, surgical and non-surgical options for the least fit patients. Aware of how disease stage may modify treatment recommendations.
Peri-operative Care	Basic understanding of anaesthetic techniques and how they may interact with surgery. Understanding of pro and cons of laparoscopic and robotic surgery. Awareness of the use of and mechanism of surgical equipment: diathermy, sealing devices, CUSA, lasers, intermittent calf compression, haemostatic agents, antibiotics, radioisotopes, fluorescence.
Post-operative care and rehabilitation	Detailed understanding of how to manage post-operative complications, including sepsis, bleeding, wound breakdown, anastomotic leakage, renal and respiratory failure, flap or tissue necrosis and venous thromboembolism. Understands the role of professions allied to medicine in the recovery process: physiotherapists, occupational therapists, dieticians, psychologists. Knowledge of post-operative management: analgesia, anti-emesis, wound care, stoma care, graft and flap care, prophylactic antibiotics, nutrition.
The role of the MDT	The role of the MDT and each of its members.
Communication skills	Experience and expertise in discussing a new cancer diagnosis and a terminal disease diagnosis with a patient. Aware of the needs of the patient for information, sensitivity, involvement and feedback. Awareness of the psychological and emotional impact of the consultation and able to empathise and manage appropriately. Understanding of how to deal with complaints and litigation.

4.0. Training Recommendations

Sergio Sandrucci & Ibrahim Edhemovic.

A surgical oncologist must receive training in a fully multidisciplinary environment with regular interaction between surgical, medical and radiation oncologists, pathologists, radiologists and a range of other disciplines involved in cancer care and cancer research. Ideally all should receive at least some of their training in a European centre of excellence.

The following represent an inspirational blueprint for surgical oncology training in Europe.

4.1. Training Programme Content

In line with current practice across most European countries, the training period is usually 6 years with a common stem in General Surgery for at least 2 years followed by 4 years specialising in Surgical Oncology. The latter period should include involvement in research and a minimum of 1 year in a major teaching centre (National or International Cancer Centre).

4.2. Multidisciplinary Team Meetings

As a minimum, the trainee should attend 1 multidisciplinary cancer team meeting per week and should be expected to play an active role.

4.3. Surgery

They should receive direct operative training by experienced and accredited trainers in minor, intermediate, major and complex major surgery as their experience progresses. For all sub-specialist index procedures, they should receive direct verbal and formal feedback and maintain a logbook of all cases. By the completion of their training, trainees should be able to demonstrate that they can undertake complex major surgery in their chosen specialist area, to a high standard and unsupervised based on their training and feedback logs.

4.4. Consulting/Clinic

Trainees should receive regular, at least twice weekly, supervised training in clinic. This should involve diagnostic and management consultations as well as breaking bad news. Regular performance appraisal should be undertaken by their trainer with both immediate verbal and written feedback of index consultations. Formalized training in communication skills is advisable.

4.5. Research

Trainees should be encouraged to take part in research recruitment for any large multicentre studies run through their units and must receive formal training in research governance, ethics and research methods. This should ideally form part of a higher degree course and should include a research project lead by the trainee themselves.

4.6. Appraisal and mentoring

All trainees should have regular meetings with a mentor to discuss their progress and training needs and should have annual appraisal of performance with the training program director.

4.7. Teaching and Education

All trainees should have access to regular (at least monthly) high quality teaching, journal club and case review meetings (audit/morbidity and mortality meetings). In addition, they should be encouraged to attend National and International Oncology meetings.

Training Units should have access to a full online library of medical literature with books, journals and access to On-Line journals and electronic CME resources.

Trainees should work in Units with access to the most up to date investigational tools to permit practice at the forefront of their field of practice (PET Scans, MRI scanners, laparoscopic equipment, genetic analysis, basic science laboratories). These may not be present in all units, but smaller units may offer integrated programs with other geographically linked units.

5.0. Eligibility Criteria for the EBSQ Examination in Surgical Oncology

Sergio Sandrucci & Ibrahim Edhemovic.

1. Each candidate must hold a current **licence to practise** as a general surgeon at the time of the examination.
2. Each candidate must have received **certificate of specialist training** from a European Union or associated country. Since 2010, candidates trained outside Europe are entitled to apply for the examination.
3. Each candidate must be able to demonstrate that he/she had **worked for a minimum of two years** in a designated cancer centre specialising in surgical oncology*

*In addition to a completed application form and a curriculum vitae, candidates will be required to submit a letter from their Head of Department supporting the application.

4. A **logbook of operative procedures** in surgical oncology, including information on whether the candidate was First Assistant (A), Principal Surgeon assisted by Trainer (B) or Principal Surgeon not assisted by Trainer (C) must be included with this application. This list of operative procedures must be signed and stamped by the appropriate trainer.

Each candidate must hold a current licence to practise as a general surgeon at the time of the examination. Each candidate must have received certificate of specialist training from a European Union or associated country. Since 2010, candidates trained outside Europe are entitled to apply for the examination. A copy of the certificate of completion of training must be enclosed with the application.

At least one of the following criteria must be met:

- Each candidate must be able to demonstrate that he/she had worked for a minimum of two years in a designated oncology centre specialising in surgical oncology

  or.

- A minimum of three years if this experience was not in a designated oncology centre or had followed a surgical oncology clinical fellowship of one year

  or.

- Specialist training of one year working as a surgeon in a recognised oncology related field

  or.

- A surgical oncology research fellowship plus two years in a clinical surgical oncology setting

In addition to a completed application form and a curriculum vitae, candidates will be required to submit a letter from their Head of Department supporting the application.

A log book of operative procedures in surgical oncology, covering a period of at least three years, including information on whether the candidate was first assistant (A), principal surgeon assisted by trainer (B) or principal surgeon not assisted by trainer (C) must be included with this application. Please note that at the beginning of the logbook, all operations must be grouped, sorted and counted by the type of operation and position of the candidate (e.g.: modified radical mastectomy – first assistant – 4 operations, low anterior resection – principal surgeon – 3 operations and so on). Without this, logbook will not be accepted. The list of operative procedures must be signed and stamped by the appropriate trainer.

Suggested further reading

Basic Science

Oxford Textbook of Cancer Biology. Pezela F, Tavassoli M, Kerr D. Oxford University Press. 2019
Molecular Biology of Cancer: Mechanisms, Targets, and Therapeutics. Pecorino L. (4th ed.). Oxford University Press, 2016

Surgical Oncology

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Colorectal Surgery: A Companion to Specialist Surgical Practice 6th ed. Sue Clark. Elsevier 2018.
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