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ECCO Essential Requirements for Quality Cancer Care: Soft Tissue Sarcoma in Adults and Bone Sarcoma. A critical review

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ABSTRACT

Background: ECCO essential requirements for quality cancer care (ERQCC) are checklists and explanations of organisation and actions that are necessary to give high-quality care to patients who have a specific tumour type. They are written by European experts representing all disciplines involved in cancer care.

ERQCC papers give oncology teams, patients, policymakers and managers an overview of the elements needed in any healthcare system to provide high quality of care throughout the patient journey. References are made to clinical guidelines and other resources where appropriate, and the focus is on care in Europe.

Sarcoma: essential requirements for quality care

• Sarcomas – which can be classified into soft tissue and bone sarcomas – are rare, but all rare cancers make up more than 20% of cancers in Europe, and there are substantial inequalities in access to high-quality care. Sarcomas, of which there are many subtypes, comprise a particularly complex and demanding challenge for healthcare systems and providers. This paper presents essential requirements for quality cancer care of soft tissue sarcomas in adults and bone sarcomas.

• High-quality care must only be carried out in specialised sarcoma centres (including paediatric cancer centres) which have both a core multidisciplinary team and an extended team of allied professionals, and which are subject to quality and audit procedures. Access to such units is far from universal in all European countries.

• It is essential that, to meet European aspirations for high-quality comprehensive cancer control, healthcare organisations implement the requirements in this paper, paying particular attention to multidisciplinarity and patient-centred pathways from diagnosis and follow-up, to treatment, to improve survival and quality of life for patients.

Conclusion: Taken together, the information presented in this paper provides a comprehensive description of the essential requirements for establishing a high-quality service for soft tissue sarcomas in adults and bone sarcomas. The ECCO expert group is aware that it is not possible to propose a 'one size fits all' system for all countries, but urges that access to multidisciplinary teams is guaranteed to all patients with sarcoma.

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Preamble

ECCO essential requirements for quality cancer care (ERQCC) are checklists and explanations of organisation and actions that are necessary to give high-quality care to patients who have a specific tumour type.

They are primarily organisational recommendations, not clinical guidelines, and are intended to give policymakers and managers, oncology teams and patient groups a non-technical overview of the elements needed in any healthcare system to provide high-quality care throughout the patient journey. References are made to clinical guidelines and other resources where appropriate, and the focus is on care in Europe.

The foundation of this ECCO requirements series is the concept of quality, which has become increasingly important in all aspects of healthcare, as the population has an increasing number of older people needing care, as many new and complex treatments come into use, and as more pressure is put on using resources effectively. Policymakers and patients need to know that their healthcare workforce, technology and facilities are configured optimally for each illness. In this context, improving quality means delivering cancer care that is timely, safe, effective and efficient; puts the patient at the centre of care; and gives all people equal access to high-quality care.

The structure of the ECCO ERQCC series is the same for each tumour type:

- Introduction: why we need cancer quality frameworks
- Key facts and challenges associated with the tumour type, from diagnosis to treatment, to follow-up
- Organisation of care: an overview of the patient pathway and overall requirements to deliver care
- Multidisciplinary working: in more detail, the requirements for core and 'expanded' teams involved in the patient pathway
- Measurement and accountability: quality assurance and audit, patient involvement and access to information.

Essential requirements for quality cancer care: sarcoma summary points

- Sarcomas – which can be classified into soft tissue and bone sarcomas – are rare, but all rare cancers make up more than 20% of cancers in Europe, and there are substantial inequalities in access to high-quality care. Sarcomas, of which there are many subtypes, comprise a particularly complex and demanding challenge for healthcare systems and providers. This paper presents essential requirements for quality cancer care of soft tissue sarcomas in adults and bone sarcomas.
- High-quality care must only be carried out in specialised sarcoma centres (including paediatric cancer centres) which have both a core multidisciplinary team and an extended team of allied professionals, and which are subject to quality and audit procedures. Access to such units is far from universal in all European countries.
- It is essential that, to meet European aspirations for high-quality comprehensive cancer control, healthcare organisations implement the requirements in this paper, paying particular attention to multidisciplinarity and patient-centred pathways from diagnosis and follow-up, to treatment, to improve survival and quality of life for patients.

1. Introduction

1.1. Why we need quality frameworks

There has been a growing emphasis on driving up quality in cancer organisations, given that there is wide agreement that much care is not comprehensively accessible, not well coordinated and not based on current evidence. This is the starting point of a report by the US Institute of Medicine (IOM) in 2013 (Levit et al., 2013), which is blunt in describing a 'crisis in cancer care delivery', as the growing number of older people will mean rising cancer incidence and numbers of survivors, while there are pressures on workforces amid rising costs of care and complexity of treatments.

Not least, the IOM notes that the few tools currently available for improving the quality of cancer care – quality metrics, clinical practice guidelines and information technology – are not widely used and all have serious limitations.

An assessment of the quality of cancer care in Europe was made as part of the first EU Joint Action on Cancer, the European Partnership for Action Against Cancer (EPAAC, http://www.epaac.eu), which reported in 2014 that there are important variations in service delivery between and within countries, with repercussions in quality of care. Factors such as waiting times and provision of optimal treatment can explain about a third of the differences in cancer survival, while cancer plans, for example a national cancer plan that promotes clinical guidelines, professional training and quality control measures, may be responsible for a quarter of the survival differences.

EPAAC paid particular attention to the importance of providing multidisciplinary care for each tumour type, going as far as issuing a policy statement (Borras et al., 2014) that emphasised the importance of team working, as cancer care is undergoing a 'paradigm shift' from a disease-based approach to a patient centred one, in which increasingly more attention is paid to psychosocial aspects, quality of life, patients' rights and empowerment, comorbidities and survivorship. EPAAC further focused on the establishment of networks of expertise in regions where it is not possible to establish comprehensive centres. Another important outcome of EPAAC is the development of the European Standards of Care for Children with Cancer (European Society for Paediatric Oncology, 2009), which support this paper where children and adolescents are concerned.

The EU Joint Action on Cancer Control (CANCON, http://www.cancercontrol.eu), which replaced EPAAC from 2014, is also focusing on quality of cancer care and is due to publish in 2017 the *European Guide on Quality Improvement in Comprehensive Cancer Control*.

Countries have been concentrating expertise for certain tumour types in dedicated centres, or units, such as for childhood and rare cancers, and most comprehensive cancer centres have teams for the main cancer types. For common adult tumours, however, at the European level there has been widespread effort to establish universal, dedicated units only for breast cancer, following several European declarations that set a target of the year 2016 for care of all women and men with breast cancer to be delivered in specialist multidisciplinary centres. While this target has been far from met (Cardoso et al., 2016), the view of ECCO's essential requirements expert group is that the direction of travel is for all tumour types to adopt the principles of such dedicated care.

As a rare group of cancers, many people with sarcomas are already referred to specialist centres, but this again is far from universal. All patients must have access to the care pathways and

multidisciplinary teams described in this document, and which are subject to same approach to auditing, quality assurance and accreditation of a 'unit' that is emerging in breast cancer.

2. Soft tissue sarcomas in adults and bone sarcomas: key facts and challenges

2.1. Key facts

- Sarcomas are cancers that are classed as 'rare', which means they have a prevalence (people living with the diseases) of fewer than five cases in a population of 10,000, and an incidence of fewer than six in 100,000 a year (Rare Cancers Europe, http://www.rarecancerseurope.org/About-Rare-Cancers).
- Sarcomas are among the largest groups of rare cancers. There are two main categories: soft tissue and bone sarcomas.
  - Soft tissue sarcomas are cancers that occur in many parts of the body. They are malignancies of mesenchymal (supporting) tissues and are named by the site or type of tissue affected. Gastrointestinal stromal tumour (known as GIST, and one of the most frequent sarcomas), affects the wall of the gastrointestinal tract and is usually put into a separate category to other sarcomas. The incidence of adult soft tissue sarcomas is about 4 per 100,000 a year in Europe and they comprise more than 80% of sarcomas. They are distinct from childhood soft tissue sarcomas – the latter are common types of rare paediatric cancers and have different characteristics, treatment protocols and guidelines and so are not included in this document; see the European Society for Paediatric Oncology (SIOPE, https://www.siope.eu) and the SIOPE strategic plan (Vassal et al., 2016) for more information.
- Bone sarcomas are primary cancers that arise from bone. They are less common than adult soft tissue sarcomas, comprising about 15% of sarcomas in Europe. The most common types are osteosarcoma and Ewing sarcoma, which have the highest incidence in adolescents and young adults, and are included in this document as treatment strategies are similar to those for adults. The most common adult bone sarcoma is chondrosarcoma. Other bone sarcomas include undifferentiated pleomorphic sarcomas of bone (UPS), chordomas and giant cell tumours of bone. The European Standards of Care for Children with Cancer also apply to bone sarcomas in children and adolescents.

- There are dozens of types of adult soft tissue sarcomas and adult/child bone sarcomas, with widely different patterns of stage at diagnosis, prognosis and treatments. The Eurocare-5 survival study (Baili et al., 2015) gives a 60% 5 year survival for cancers classed as arising from 'soft tissue' and just over 50% for those classified as arising from 'bones and cartilages', indicating that as whole, sarcomas are in the mid- to upper-level in 5 year survival rates. Detailed data have been published for the first time in 2013 by RARECARE (http://www.rarecare.eu), which carries out surveillance of rare cancers in Europe. It found that the incidence of all type of sarcoma is about 6 in 100,000, with 28,000 new cases a year in Europe; in 2008, 280,000 people were estimated to be alive following a diagnosis. Details of 5 year survival of various types and sites of sarcoma are given in a RARECARE paper (Stiller et al., 2013).
- The cause of most sarcomas is unknown. Half of patients have an excess of pathogenic (and potentially aetiological) germline variants (Ballinger et al., 2016). Risk factors for soft tissue sarcomas include age (about one third are diagnosed in people aged 65 and older, and this group has the lowest survival rates for most sarcomas), previous radiation treatment, previous cancers, and rare genetic conditions that are present in families. Kaposi's sarcoma is caused by a virus and mainly seen in people with HIV infection, and should be distinguished from other sarcomas. Osteosarcoma in older people may be associated with Paget's disease.

2.2. Diagnosis and treatment

- Symptoms of adult soft tissue sarcomas include lumps and pain. Diagnosis is by imaging and biopsy. Common symptoms of bone sarcomas are pain, swelling and problems with movement.
- A diverse range of treatments are carried out for the many types of sarcoma (Casali, 2016). Surgery is the main treatment for most sarcomas, and can include limb-sparing operations or amputation where, infrequently, this is the only option to eliminate the cancer. Chemotherapy and radiotherapy may also be used before surgery (to devitalise tumours) and after (to prevent recurrence) depending on the histology and the risk of relapse. Several targeted therapies are used in sarcomas, notably imatinib to treat GIST.

2.3. Challenges in sarcoma care

2.3.1. Access to specialists

- An overall challenge for sarcomas is the availability of experts and multidisciplinary groups and networks. This is often the case with rare diseases such as sarcomas, and some smaller countries may even lack a specialised sarcoma unit.

2.4. Diagnosis

- The rarity of sarcomas, the large number of types, and often vague symptoms mean that most primary care doctors will infrequently encounter a person with sarcoma. Further, a benign diagnosis may outnumber the diagnosis of sarcoma by a factor of 100. This can result in late diagnoses and delayed referrals.
- Radiologists and pathologists specialising in sarcomas play a crucial role in the correct diagnosis of sarcomas, but are usually based only in a few centres. Surgical biopsies not performed by experts can lead to complications, impairments to subsequent treatments and possibly tumour spread. A study from 2012 (Ray-Coquard et al., 2012) concluded that more than 40% of first histological diagnoses were modified at second reading, possibly resulting in different treatment decisions, and the ECCO expert group stresses that diagnosis must only take place in sarcoma centres or paediatric cancer centres with expertise in treating sarcomas (Beishon, 2013).
- In sum, there can be profound implications for a patient not diagnosed at a sarcoma centre, such as missing the chance of a timely diagnosis of a potentially curable disease, and being spared more extensive surgery.

2.5. Treatment

- Surgery for sarcomas can be difficult and needs highly experienced surgeons to achieve the best outcomes. A study from 2004 (Ray-Coquard et al., 2004) showed that more than 50% of soft tissue sarcoma patients are not correctly operated on.
- After some time with little change in drug treatments (mainly chemotherapy) for metastatic sarcomas, there are now several new systemic and targeted drugs for adult soft tissue sarcomas, either approved or that show promise in clinical trials, following advances in understanding the molecular biology of sarcomas, and medical oncologists face increasingly complex treatment choices. As about half of patients with intermediate and high-grade sarcomas will have a recurrence, their best management is crucial.

- Osteosarcoma, Ewing sarcoma and bone UPS have a high risk of metastatic spread, particularly to the lungs and to distant bones, and treatment aimed at local control of the primary tumour is rarely curative unless integrated into a multidisciplinary treatment concept with multi-agent chemotherapy. Up to two thirds of patients may become long-term, disease-free survivors, provided they receive high-quality multidisciplinary care.

2.6. Inequalities

- People with sarcomas in Central and Eastern Europe have lower 5 year survival rates than those in other countries. This is particularly true of bone sarcomas and GIST, and the RARECARE paper notes that outcomes for bone sarcomas, in particular, depend on multidisciplinary teams, which may be lacking in a number of countries, and not only in Central and Eastern Europe (Stiller et al., 2013).

2.7. Young people

- While paediatric cancer units are available in many countries, units with expertise and appropriate facilities to meet the needs of adolescents and young adults (AYA) are fewer, but are also required.

2.8. Survivorship

- Although the number of people in Europe who have had treatment for sarcoma is small compared with those who have had common cancers, survivors can have a wide range of needs, including rehabilitation and surveillance for late toxicities.

3. Organisation of care

Essential requirements for the organisation of sarcoma care are:

- Cancer care pathways that cover the entire patient journey
- Timeliness of care
- Minimum case volumes for sarcoma centres
- Multidisciplinary team working including core and extended groups of professionals, in dedicated sarcoma centres or units
- Audit and quality assurance of outcomes and care processes
- Education, policies to enrol patients in clinical trials, patient information.

These topics are outlined in the following sections, with reference to national and European resources and clinical practice guidelines, where appropriate.

3.1. Sarcoma units/centres

- It is essential that treatment is organised in units or centres that specialise in sarcomas, often termed ‘reference centres’, which are also often part of networks at an appropriate geographical level (regional, national and supranational). Diagnosis and many treatment procedures must only be performed in the sarcoma centre, although professionals at a centre can also be part of an extended multidisciplinary team (MDT) covering other institutes and networks.
- Treatment of childhood sarcomas is usually organised in paediatric cancer centres that also treat other paediatric cancers. For the purpose of this paper, the term ‘sarcoma centre’ also applies to paediatric cancer centres.
- It is essential that the sarcoma centre and the members of the MDT have a significant annual number of cases and that the core MDT has members with sarcomas as their only, or one of their primary, interest(s). On the basis of existing evidence, the expert group recommends that for an institution to be considered as a sarcoma centre it should treat at least 100 new sarcoma patients (both soft tissue and bone) a year, although a threshold will depend on the structure of sarcoma networks in a region or country and the distribution of expertise. Guidance from the National Institute for Health and Care Excellence (NICE) in England and Wales says that MDTs managing either soft tissue sarcoma or bone sarcoma should manage the care of at least 100 new patients a year (100 soft tissue and 50 bone sarcomas if the MDT manages both types), reflecting the more centralized nature of the UK’s health system (National Institute of Health and Care Excellence, 2006). Note that owing to the rarity of paediatric cancer in general and bone sarcoma in particular, minimum case volumes are necessarily different between adult and paediatric treatment centres.
- RareCareNet, a European Union information network on rare cancers, has set out criteria for a sarcoma referral centre, and which are discussed in a paper, ‘Accreditation for centres of sarcoma surgery’ (Sandrucci et al., 2016).

3.2. Care pathways and timelines

- Care for sarcoma patients must be organised in pathways that cover the patient’s journey from their point of view rather than that of the healthcare system, and pathways must correspond to current national and European evidence-based clinical practice guidelines on diagnosis, treatment and follow-up. (The European Pathway Association defines a care pathway as “a complex intervention for the mutual decision making and organisation of care processes for a well-defined group of patients during a well-defined period”. This broad definition covers terms such as clinical, critical, integrated and patient pathways that are also often used. See http://e-p-a.org/care-pathways). One source of information on care organisation is again NICE – it has published documents including a manual on improving sarcoma outcomes (National Institute of Health and Care Excellence, 2006), a pathway (http://pathways.nice.org.uk/pathways/sarcoma), and a quality standard (see section on auditing, quality assurance and accreditation). Pathways for soft tissue and bone sarcomas are different, and there are examples of such pathways (e.g. NHS London and South East Sarcoma Network, http://www.lsesn.nhs.uk/sarcoma.html).
- Primary care practitioners, general surgeons and medical oncologists are often referrers of those with suspected sarcoma and need timely access to reference centres. The maximum time for an appointment for suspected adult cancer in England and Wales is 2 weeks, for example. NICE also recommends that children and young people with suspected bone sarcoma on an x-ray are referred within 48 h for an appointment with a specialist, and also within 48 h for unexplained bone pain or swelling.
- Reasonable times to report a diagnosis of sarcoma and the opportunity to start treatment are crucial to timely treatment and to the wellbeing of patients. For example guidelines in the Netherlands state that the maximum time for diagnostic and staging procedures is 3 weeks, and the maximum time from first appointment to first treatment is 6 weeks, but shorter times should be aimed for.
- After a diagnosis, it must be clear to the patient which professional is responsible for each step in the treatment pathways and who is following the patient during the journey (usually called a case manager or patient navigator) (Albreht et al., 2015). In many countries, case managers during the main stages of treatment are cancer nurses.
- Follow-up and survivorship are major issues in sarcoma. Typically, care pathways include surveillance for cancer recurrence

but patients often have to seek help elsewhere for long term side-effects of treatment, by going to both acute and community facilities. Continuity and integration of all care by specialists must be implemented as gaps in long-term care can cause much distress.

3.3. European networks and societies

Sarcoma centres must also participate in European sarcoma care and research networks and societies. Such organisations play a crucial role in pooling expertise in all rare cancers. In sarcoma, research groups include the Soft Tissue and Bone Sarcoma Group at EORTC (European Organisation for Research and Treatment of Cancer), and the Euro Ewing Consortium; and professional societies include the European Musculo-Skeletal Oncology Society (EMSOS) and the Connective Tissue Oncology Society (CTOS).

A challenge is sustainability of networks, and the rare cancer community has been lobbying for funding, including from the new European Reference Networks (ERNs) (Wagstaff, 2016) (Blay et al., 2016a). Applications for ERNs on rare cancers, including adult sarcomas and childhood sarcomas, are currently being reviewed by the European Commission; quality of care requirements will be an important part of the work of these networks. The EU Joint Action on Rare Cancers will also support the creation of ERNs in the EU.

3.4. The multidisciplinary team

Treatment strategies for all patients must be decided on, planned and delivered as a result of consensus among a core multidisciplinary team (MDT) that comprises the most appropriate members for the particular diagnosis and stage of cancer, patient characteristics and preferences, and with input from the extended community of professionals. The heart of this decision-making process is normally a weekly or more frequent MDT meeting where all patients are discussed with the objective of balancing the recommendations of clinical guidelines with the often formidable complexity of the individual sarcoma patient.

To properly treat sarcomas it is essential to have a core MDT of dedicated health professionals from the following disciplines:

- Radiology/imaging
- Interventional radiology
- Pathology
- Surgery
- Radiotherapy
- Medical and paediatric oncology
- Nursing.

This core MDT meets to discuss:

- All cases after diagnosis and staging to decide on optimal treatment
- All cases prior to local treatment (surgery, radiotherapy or chemotherapy (Gronchi et al., 2016))
- Patients after major treatment, usually surgery, to decide on further treatment and follow-up
- Patients with a recurrence during follow-up, or where changes to treatment programmes are indicated and have multidisciplinary relevance and/or planned deviations from clinical practice guidelines.

In addition, sarcoma radiologists should participate in meetings where discrepancies between radiology and histology, as well as mistakes, are discussed. When there is a discrepancy between a radiologist not based at the centre and the final diagnosis, feedback should be provided in an open and non-judgmental manner, helping to raise standards among non-sarcoma radiologists.

Healthcare professionals from the following disciplines must also be available whenever their expertise is required (the 'expanded' MDT):

- Nuclear medicine
- Oncology pharmacy
- Geriatric oncology
- Psycho-oncology
- Palliative care
- Rehabilitation and survivorship.

There is also an increasing sub-group of sarcomas that have a genetic predisposition. It may be necessary soon to add a clinical geneticist to the expanded MDT to discuss options for genetic testing and its results with patients and their families.

All decisions have to be documented in an understandable manner, and should become part of the patient records. It is good practice for decisions taken during MDT meetings to be monitored, and deviations reported back to the MDT where there are problems.

It is essential that all relevant patient data, such as pathology reports, meet quality standards and are available at the time of the MDT meeting.

4. Disciplines within the core MDT

4.1. Radiology/imaging

Radiology/imaging plays a critical role in diagnosing, staging and follow-up of sarcomas and personalised treatment. The role of the radiologist is to perform and interpret relevant imaging procedures as part of the diagnosis of sarcomas.

Essential requirements:

- Sarcoma centres must have radiologists who have significant expertise in the diagnosis, staging and follow-up of sarcomas
- Radiologists must have access to imaging modalities required for diagnosing and staging of sarcomas (e.g. ultrasound, radiographs, CT, MRI)
- The radiologist must know when to refer a patient to nuclear medicine. In that case (referral for bone scintigraphy, SPECT/CT or PET/CT), nuclear medicine physicians and radiologists must liaise to allow joint patient management, reading and reporting
- Sarcoma radiologists must collaborate with other specialist radiologists (e.g. ENT radiologists and paediatric radiologists), as sarcomas affect a wide variety of organs and ages
- Imaging and histopathology findings should be discussed together before making a diagnosis, to minimise diagnostic discrepancies. This is of particular importance in bone tumours and tumour-like lesions where conditions such as myositis ossificans may be misinterpreted as osteosarcoma on histopathology, or in cases where the obtained biopsy may not be representative of the entire lesion (Nuovo et al., 1992) (Noebauer-Huhmann et al., 2015) (SLICED, 2007)
- For bone sarcomas and other sarcomas in children, adolescents and young adults, radiologists need experience with these age groups.

4.2. Interventional radiology

Interventional radiology plays an important role in the diagnosis of sarcomas. Indeed, image-guided percutaneous core needle biopsy is crucial in the delivery of a safe and efficient sarcoma

service, and is the preferred biopsy technique in the diagnosis of sarcomas. The role of the interventional radiologist is to:

- Perform image-guided percutaneous core needle biopsy of supposed sarcoma and to perform biopsy in case of unclear hepatic or pulmonary lesions (Yang and Damron, 2004)
- Provide expertise and support for combined therapies in patients with metastatic disease (e.g. transarterial treatments or ablative therapies)
- Perform appropriate minimally-invasive therapies according to the MDT's decision.

Essential requirements:

- Biopsies must be performed in sarcoma centres
- Interventional radiologists performing image-guided biopsies for a sarcoma centre must have training and experience (Lee et al., 2012), have access to appropriate imaging equipment and must implement the WHO Surgical Safety Checklist
- Interventional radiologists must work with the MDT to plan the biopsy to avoid the risk of 'contamination' of other compartments, which may significantly hamper surgical resection
- The interventional radiologist must discuss the role and propose use of local ablative techniques for treating liver, lung or bone metastases not amenable to, or combined with, surgery or radiotherapy (Koelblinger et al., 2014) (Falk et al., 2015) (Jiang et al., 2016)
- For bone sarcoma and other sarcoma biopsies in children, adolescents and young adults, interventional radiologists need sarcoma experience with these age groups.

4.3. Pathology

Specialist pathologists are needed for diagnostic accuracy of sarcomas given their rareness, the large number of histotypes and the morphological overlap between benign and malignant cases. As diagnosis drives treatment options, a dedicated and experienced pathologist must be in the core MDT from the start. In several countries there are panels of experienced pathologists that have substantial impact on diagnostic accuracy and subsequent treatment results (Jansen-Landheer et al., 2009). Adequate sampling is needed for histology. While open biopsies offer more tissue sometimes needed for molecular and immunohistochemical techniques, most centres use thick core needle biopsies to obtain material for histology both for soft tissue and bone tumours (The ESMO/European Sarcoma Network Working Group, 2014a,b).

Essential requirements:

- The pathologist must establish a correct diagnosis according to the 2013 WHO classification, and in case of malignancy predict tumour behaviour by stating the tumour grade. In soft tissue tumours this is done according to the FNLCC criteria (Neuville et al., 2014) and, when needed, by additional molecular techniques (Hogendoorn et al., 2004)
- Access to a molecular biologist must be guaranteed (not necessarily on site) and material for molecular testing must be set aside and preserved according to guidelines
- There must be a double-reading of the slides not only when the biopsy was done outside a sarcoma centre (which must be avoided where possible) but also if the biopsy was done in the sarcoma centre.

4.4. Surgery

Surgery is the mainstay of the treatment of sarcomas, especially in primary disease. All non-metastatic adult-type primary sarcomas are removed (resected) when possible as part of frontline treatment; surgery alone can cure more than half of adult-type sarcoma patients (Gronchi et al., 2015) (Le Cesne et al., 2014). For patients with metastatic disease and local recurrence, surgery can also be an important part of treatment. Surgical margins are a major prognostic factor concerning the risk of local recurrence in limbs, and en-bloc resection is a determinant prognostic factor of overall survival in retroperitoneal sarcoma (RPS). The experience of the surgeon is a prognostic factor of overall survival in RPS, and surgery at a sarcoma centre achieves better margins (Blay et al., 2016b).

The role of the chief surgeon at a sarcoma centre is to:

- Coordinate diagnostic procedures, surgery and perioperative care
- Perform appropriate surgery as decided in the MDT.

Essential requirements:

- Surgery must only be performed in a sarcoma centre by surgical oncologists with significant expertise in sarcomas
- A sarcoma surgeon should carry out at least 3–4 procedures a month (30–40 a year) and they must participate in sarcoma groups and meetings at national and/or international level. It is good practice for activity and outcomes to be published, and in future the expert group recommends that education/fellowship in sarcoma management is required
- Visceral surgical oncologists must be able to perform multivisceral resections, including digestive and urologic organs in one bloc; plan (with a multidisciplinary surgical team) which organs/structures to sacrifice, with the potential for local control weighed against the potential for long-term dysfunction; and have expertise in procedures such as full-thickness thoracoabdominal wall, diaphragmatic and major vascular resection and reconstruction. All these abilities may also be available among multidisciplinary surgical teams, but the sarcoma surgeon must be able to plan collaborations when necessary
- Bone sarcomas must be operated on by a specialist surgeon. In most cases this is an orthopaedic surgeon, but can also be a paediatric surgeon or another surgeon depending on the sarcoma location. These surgeons must have significant experience in bone sarcoma treatment
- The sarcoma centre should treat at least 100 patients per year if the MDT manages both bone and soft tissue sarcoma patients. Owing to the rarity of paediatric cancer in general and bone sarcoma in particular, this volume requirement does not apply to paediatric centres treating bone sarcomas in children, adolescents and young adults. The structure of sarcoma networks in a region or country and the distribution of expertise is another parameter influencing volume requirements
- There must be an intensive care unit in sarcoma centres
- Access to a plastic/reconstructive surgeon must be guaranteed
- For bone sarcoma and other sarcomas in children, adolescents and young adults, surgeons need sarcoma experience with these age groups. This is particularly important for bone sarcoma surgery in young people who have not reached skeletal maturity.

4.5. Radiotherapy

As described in the NCCN and ESMO guidelines (neo-)adjuvant radiotherapy should be considered for non-metastatic sarcomas of intermediate and high grade malignancy; it is much less relevant for low grade sarcomas (von Mehren et al., 2016) (The ESMO/European Sarcoma Network Working Group, 2014b) (Haas

et al., 2012) (O'Sullivan et al., 2013). The role of the radiation oncologist is to determine and prescribe the most suitable dose of radiation to deliver in a particular case, and the method and technique by which this will be achieved. Except for Ewing sarcomas, chordomas and chondrosarcomas (derived from the base of skull, spine and sacrum), radiotherapy is rarely used in bone sarcomas as the only curative treatment, owing to radioresistance which requires higher doses that increase side-effects. It is important to note that the quality of radiotherapy is significantly associated with local control, and quality assurance is mandatory for these types of cancer (Donaldson et al., 1998).

Essential requirements:

- Radiation oncologists must have expertise in sarcoma subtypes and especially the probability of local recurrence per subtype
- They must know the indications and contra-indications for (neo)adjuvant and definitive radiotherapy, counsel patients prior to surgery on the choice of neoadjuvant or adjuvant therapy, and inform patients about acute and late side-effects, and interventions to prevent them from happening or worsening
- The centre must have access to latest technologies such as IMRT, IMAT and stereotactic (body) radiotherapy, with a state of the art mould room to make personalised immobilisation devices
- The centre must be able to perform (daily) online setup verification protocols and to react according to deviations observed. Prospective quality assurance protocols must be in place
- The centre must organise treatment at a proton/heavy ion radiotherapy centre if needed (DeLaney and Haas, 2016)
- For bone sarcomas and other sarcomas in children, adolescents and young adults, radiation oncologists need sarcoma experience with these age groups.

4.6. Medical and paediatric oncology

Medical therapy is needed in most patients with advanced disease for all sarcomas, in virtually all patients with osteosarcoma and Ewing sarcoma, and in many high-risk soft tissue sarcoma and GIST patients with localized disease (The ESMO/European Sarcoma Network Working Group, 2014b) (Neuville et al., 2014). It is also often used as front-line therapy before surgery. Medical therapy is becoming highly variable depending on the pathologic and molecular characteristics of the patient. Tumour response to medical therapy may present peculiar patterns, especially in bone sarcomas, GIST and with some molecularly targeted therapies in soft tissue sarcomas.

Given the rarity of sarcomas, and that medical therapy often takes many months to administer, medical oncologists should be prepared to work in health networks that care for adult patients close to their home.

Essential requirements:

- Medical therapy must be planned and administered by a medical oncologist, or a paediatric oncologist for young patients, from the beginning of the patient's journey, in collaboration with the MDT and closely following imaging (with regard also to unconventional patterns of tumour response)
- The medical/paediatric oncologist must have specialised expertise in sarcomas with experience from working in a sarcoma reference centre and/or a sarcoma reference network. Sarcomas must be a major component of their work
- Medical/paediatric oncologists must be involved in sarcoma clinical research collaborative groups at a national and/or international level.

4.7. Nursing

Nurses are the professionals who spend most time caring for people with sarcoma, and require a range of roles, owing to the diversity of tumour types and contexts of care. They need specialised knowledge and skills to nurse people receiving complex, multi-modal sarcoma treatments, which have a high degree of morbidity (Samuel, 2018).

Essential requirements:

- Nurses must conduct holistic nursing assessments to ensure safe, personalised and age-appropriate nursing care, and provide patient information and support to promote self-efficacy throughout the patient journey
- Nurses must provide intensive care following surgery; care for patients who have had tissue conservation, bone fixation, limb salvage or surgical reconstruction; care for patients receiving high-dose chemotherapy; and care for patients receiving adjuvant radiation therapy, including brachytherapy (Lahl et al., 2008)
- They must alleviate symptoms of sarcoma (e.g. pain, fatigue, spinal cord compression); prevent or manage side-effects of treatment (e.g. radiation-induced skin injury, change in body appearance and/or function); and care for patients with treatment-related complications (e.g. wound infection, flap necrosis, neutropenic sepsis, acute kidney injury)
- When acting as case managers, nurses must coordinate care with health professionals outside the core MDT, including rehabilitation, psychosocial, fertility and palliative care services (Prades et al., 2015).

5. Disciplines within the expanded MDT

5.1. Nuclear medicine

Bone scintigraphy, SPECT/CT with various radiotracers, and PET/CT with ^{18}F FDG and ^{18}F-FNa may be indicated in certain sarcomas (musculoskeletal soft tissue sarcomas, bone sarcomas and GIST) for prognosis, staging, treatment response evaluation, and restaging (to confirm limited or resectable disease before curative intent therapy, and for local recurrence and metastases) (Nanni et al., 2009) (Gabriel and Rubello, 2016).

The role of the nuclear medicine physician is to oversee all aspects of bone scintigraphy, SPECT/CT and PET/CT for patients who require these procedures, including indications, multidisciplinary algorithms and management protocols.

Essential requirements:

- Nuclear medicine physicians with expertise in PET must be available to the MDT. In 2016, most European hospitals have access to PET/CT technology but it should preferably be on-site, be less than 10 years old and ready for integration in radiation treatment planning, and have integrated PACS/RIS and updated workstations
- Conventional nuclear medicine must also be available
- Nuclear medicine must be able to perform daily verification protocols and to react accordingly. Quality-assurance protocols must be in place. An option for ensuring the high quality of PET/CT scanners is provided by the European Association of Nuclear Medicine (EANM) through EARL accreditation (Boellaard et al., 2015)
- For bone sarcomas and other sarcomas in children, adolescents and young adults, nuclear medicine physicians need sarcoma experience with these age groups.

5.2. Geriatric oncology

As a third of soft tissue sarcoma patients are aged 65 or more, the MDT must have access to geriatricians with oncology experience. While chronological age should not be a reason to withhold effective therapy, goals may vary significantly according to age and requires expert geriatric input.

The role of the geriatric oncologist is to:

- Ensure that older patients are screened for frailty
- Coordinate recommendations to other specialists about the need for personalised treatment for frail patients.

Essential requirements:

- Geriatric oncologists must ensure all older patients are screened with a simple risk-assessment frailty screening tool (Decoster et al., 2015) (Huisman et al., 2014) with whenever possible an estimation of life expectancy to help prioritise medical interventions (e.g. ePrognosis colorectal screening survey. http://cancerscreening.eprognosis.org/screening)
- A geriatric oncology team (including geriatricians and other specialists) must be available for all frail patients and their evaluation discussed in MDT meetings to offer personalised treatment
- Geriatric oncologists must ensure the early integration of palliative care plans or geriatric interventions, especially for frail patients.

5.3. Oncology pharmacy

Oncology pharmacy plays a critical role in the care of sarcoma patients, given the importance of systemic treatment. The role of the oncology pharmacist is to:

- Liaise with the medical oncologist and/or paediatric oncologist to discuss pharmaceutical treatment
- Supervise the preparation of oncology drugs.

Essential requirements:

- Oncology pharmacists must work closely with medical/paediatric oncologists. They must have experience with interactions with other drugs; experience with dose adjustments based on age, liver and kidney function; and knowledge of complementary and alternative medicines. Oncology pharmacists must comply with the European QuapoS guidelines (European Society of Oncology Pharmacy, 2014)
- Oncology drugs must be prepared in the pharmacy or designated area which meets the criteria pharmacies must comply with and dispensing must take place under the supervision of the oncology pharmacist.

5.4. Psycho-oncology

About 30% of sarcoma patients suffer from anxiety at diagnosis and during treatment and 20% suffer from clinical depression (Paredes and Canavarro Simões, 2010) (Paredes et al., 2012). Treatment can seriously affect quality of life, especially for those who have major operations on limbs. Concerns about body image are particularly high in young people with bone sarcomas. Appropriate psychological interventions such as mindfulness training and psycho-educative programmes are needed for the main sarcoma age groups. Supporting family members is also essential, particularly for relations of children, adolescents and young adults.

The role of the psycho-oncologist is to:

- Ensure that psychosocial distress (National Comprehensive Cancer Network, 2003), and other psychological disorders and psychosocial needs, are identified by screening, and are considered by the MDT
- Promote effective communication between patients, family members and healthcare professionals.
- Support patients and family members to cope with multifaceted disease effects
- Facilitate the reintegration of sarcoma survivors in school, work, social and family environments through evidence-based psychoeducational interventions.

Essential requirements:

- Patients must have access to a self-administered psychological assessment tool (‘distress thermometer’)
- Psychosocial care must be provided at all stages of the disease and its treatment for patients and their families and must be present to ensure comprehensive cancer care
- In paediatric cancer, it is recommended that psychosocial support includes play therapy and access to schooling.

5.5. Palliative care

About 30–50% of patients with sarcomas die within 5 years from diagnosis, and there is an increasing need for palliative care throughout the disease trajectory, not only at end-of-life but at diagnosis and during cancer treatments to manage distressing clinical complications and symptoms and to improve the quality of life of patients and their families (Temel et al., 2010) (Hui et al., 2015) (Quill and Abernethy, 2013) (Coindre et al., 2001). Palliative care, as defined by the World Health Organization, applies not only at end of life but throughout cancer care (see http://www.who.int/cancer/palliative/definition/en).

The role of the palliative specialist is to:

- Be responsible for specialist palliative care and recommendations to other specialists regarding general palliative care (e.g. symptom control)
- Be available at diagnosis and the early phase of treatment
- Identify patients in need for palliative care through systematic assessment of distressing physical, psychosocial and spiritual problems
- Provide early palliative care in conjunction with cancer specific treatments, treat disease and treatment-related distressing symptoms such as pain and dyspnoea, and offer psychosocial and spiritual care
- Provide support for family members
- Provide end-of-life care together with primary care palliative care providers.

Essential requirements:

- There must be a palliative care team that provides expert outpatient and inpatient care
- The palliative care team must include specialist physicians and nurses, working with social workers, chaplains, psychotherapists, physiotherapists, occupational therapists, dieticians, pain specialists and the psycho-oncology team
- The palliative care unit must collaborate with community palliative care teams

- All patients with severe symptoms or suffering, or patients with metastatic disease and short life expectancy (under a year), irrespective of the cancer treatment plan, must also be in the care of palliative care team
- For bone sarcomas and other sarcomas in children, adolescents and young adults, the palliative care team needs experience with these age groups.

5.6. Rehabilitation and survivorship

Rehabilitation and survivorship plans are often omitted in the planning of clinical and psychosocial care for patients and their families. They must be integrated into pathways to ensure the best possible care continues beyond initial treatment (Stubblefield et al., 2013) (Berg et al., 2016) (Scott et al., 2013). A multidisciplinary team involving clinicians, nurses, psychologists and physiotherapists must discuss with patients how their functioning will change during and after treatment, and options for improvement.

Essential requirements:

- Many cancer patients are living longer after their treatment, but they are often not well-informed about late-effects and how their lives could be affected. Patients and their families must be better informed about potential late-effects and how these can be monitored and tackled
- Where the limbs are involved, it is important to identify rehabilitation needs related to movement and daily activities, and plan physical training accordingly
- Return to school or work is important for many cancer patients and has both financial and wellbeing benefits. Employers must have early discussions about flexibility in returning to work, such as changing job duties and working hours, including for families of patients with paediatric cancer
- Rehabilitation and survivorship of cancer must be integrated into national cancer plans.

6. Other essential requirements

6.1. Patient involvement, access to information and transparency

- Patients must be involved in every step of the decision-making process. Their satisfaction with their care must be assessed throughout the patient care pathway. Patients must be offered relevant and understandable information to help them appreciate the process that will be followed with their treatment from the point of diagnosis. They must be supported and encouraged to engage with their health team to ask questions and obtain feedback on their treatment wherever possible. Children need to be involved in an age-appropriate manner and their parents/carers should be included in the process as appropriate.
- It is also essential that sarcoma patient support organisations are involved whenever relevant throughout the patient pathway. These groups work to:
  - Improve patients' knowledge and ability to take decisions
- Secure access to innovative therapies and improve quality of treatment
- Support sarcoma research, such as by being involved in the design of clinical trials
- Advocate at national health policy level.

The Sarcoma Patients EuroNet Association (SPAEN) (www.sarcoma-patients.eu) is an international network of national sarcoma support and advocacy groups. Childhood Cancer International (CCI) is the largest patient support organisation for childhood cancer and has a European committee, CCI Europe (http://www.childhoodcancerinternational.org/cci-global-network/europe).

- Conclusions on each case discussion must be made available to patients and their primary care physician. Advice on seeking second opinions must be supported.
- Cancer healthcare providers must publish on a website, or make available to patients on request, data on centre/unit performance, including:
  - Information services they offer
- Waiting times to first appointment
- Pathways of cancer care
- Numbers of patients and treatments at the centre
- Number of operated patients at the centre
- Clinical outcomes
- Patient experience measurements
- Incidents/adverse events.

6.2. Auditing, quality assurance and accreditation

- The expanded MDT must meet at least once a year to review the activity of the previous year, discuss changes in protocols and procedures, and improve the performance of the unit/centre.
- To properly assess quality of sarcoma care, three categories of outcomes must be measured and collected in a database at the level of the specialised sarcoma centre, and regionally and/or nationally:
  - Clinical outcomes
- Process outcomes
- Patient-reported outcomes (PROs).

- Data measured and collected varies from one country to another but it is recommended that the following outcome data are systematically measured and collected:
  - 5 year survival rate,
- 5 year local recurrence rate
- 5 year local control rate
- Complications
- % of patients discussed in the MDT before any treatment
- % of postoperative patients discussed in the MDT.

The expert group also recommends that centres develop performance measurement metrics based on the essential requirements in this paper.

- The ECCO expert group recommends that further attention must be given to patient reported outcome measures (PROMs), to not only agree on which tools should be used, but also to use PROs more systematically as part of discussions and evaluation within the MDT.

To ensure appropriate, timely and high-quality care, a quality management system (QMS) must be in place. It must involve clinical care, strategic planning, human resource management, training etc. The QMS must be accountable at an institutional management level and be based on written and agreed documentation such as guidelines, protocols, patient pathways, structured referral systems and standard operating procedures (SOPs).

The QMS must ensure the continuity of care for patients, the involvement of patients in cancer care pathways, and the reporting of patient outcomes and experience. As part of a QMS, an effective data management and reporting system, and an internal audit system, are necessities. Where available, external national audit and certification systems are to be followed. The ECCO expert also strongly recommends participation in international accreditation programmes (e.g. Organisation of European Cancer

Institutes (OECI) accreditation, http://oeci.selfassessment.nu/cms) (Wind et al., 2016).

6.2.1. Country examples

- The National Institute of Health and Care Excellence (NICE) in England and Wales has published a quality standard for sarcoma (National Institute of Health and Care Excellence, 2015). It aims to ensure that people with sarcoma are treated by healthcare professionals with experience and expertise in treating sarcoma, and that people with sarcoma are informed about their condition, receive appropriate and timely advice, and can access relevant services. Statements in the standard cover referrals and treatment by MDTs, among others.
- The German Cancer Society operates a certification system for cancer centres that includes sarcomas (see https://www.krebsgesellschaft.de/gcs/german-cancer-society/certification.html).
- France has clinical and pathology networks (NetSarc and RRePS) that offer patients a means to make a systematic diagnosis of soft tissue sarcoma and help to access treatment in a specialised centre (Honoré et al., 2015).

6.3. Education and training

It is essential that each sarcoma centre provides professional clinical and scientific education on the disease and that at least one person is responsible for this programme. Healthcare professionals working in sarcoma must also receive training in psycho-social oncology, palliative care, rehabilitation and communication skills, tailored to patient age where relevant. Such training must also be incorporated into specialist postgraduate and undergraduate curriculums for physicians, nurses and other professionals. Nurses working in sarcoma centres should undertake post-qualification education and training about providing holistic care for people being treated for sarcoma throughout the patient journey.

6.4. Clinical research

Centres treating sarcoma must have clinical research programmes (either their own research or as a participant in programmes led by other centres). The research portfolio should have both interventional and non-interventional projects and include academic research.

The MDT must assess all new patients for eligibility to take part in clinical trials at the centre or in research networks. For sarcoma, centres should have at least 10% of all patients included in their research projects or in research performed in other centres. Researchers at other centres should be considered as part of the expanded MDT for at least annual discussion of clinical trial participation.

In paediatric oncology, participation in therapy-optimising studies is a standard of care in most countries. Children, adolescents, and young adults in all countries should have access to national or international multicentre studies, and accelerated access to innovative therapies if their disease progresses.

Older adults are currently underrepresented in cancer clinical trials despite having a disproportionate burden of disease (Kaźmierska, 2013). Strategies to increase the participation of older adults, adolescents and young adults in clinical trials must be implemented and trials designed to take their needs into account.

7. Conclusion

Taken together, the information presented in this paper provides a comprehensive description of the essential requirements for establishing a high-quality service for soft tissue sarcomas in adults and bone sarcomas. The ECCO expert group is aware that it is not possible to propose a 'one size fits all' system for all countries, but urges that access to multidisciplinary teams is guaranteed to all patients with sarcoma.

Conflict of interest

The authors declare no conflicts of interest.

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