GUIDELINES FOR SAFE PRACTICE OF STEREOTACTIC BODY (ABLATIVE) RADIATION THERAPY

FACULTY OF RADIATION ONCOLOGY

THE ROYAL AUSTRALIAN AND NEW ZEALAND COLLEGE OF RADIOLOGISTS®
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THE FACULTY OF RADIATION ONCOLOGY, RANZCR, is the peak bi-national body advancing patient care and the specialty of Radiation Oncology through setting of quality standards, producing excellent Radiation Oncology specialists, and driving research, innovation and collaboration in the treatment of cancer.

VISION
To have an innovative, world class Radiation Oncology Specialty for Australia and New Zealand focused on patient needs and quality.

OUR VALUES
In undertaking our activities and in managing the way we interact with our Fellows, trainees, members, staff, stakeholders, the community and all others with whom we liaise, the Faculty of Radiation Oncology, RANZCR, will demonstrate the following values:

- Quality of Care - performing to and upholding high standards
- Integrity, honesty and propriety - upholding professional and ethical values
- Patient orientation - understanding and reflecting the views of Fellows and members and working with them to achieve the best outcomes
- Fiscal responsibility and efficiency - using the resources of the College prudently.

OUR PROMISE TO THE PATIENTS
We will advocate for the best possible care for individual patients in multidisciplinary meetings and for all patients with government.

OUR PROMISE TO TRAINEES
We ensure the highest standard of training in radiation oncology by combining a world-class curriculum with passionate and supportive supervisors. The voice of trainees is valued in Radiation Oncology.

OUR PROMISE TO OUR FELLOWS
We are a member based organisation that utilises its resources effectively and strategically to fulfil our vision, purpose and core objectives. We strive for best practice and facilitate life-long learning of our members.

OUR PROMISE TO OUR PARTNERS & STAKEHOLDERS
We are a transparent and collaborative organisation that strives to promote partnerships and participation of all relevant stakeholders to ensure that patients across Australia and New Zealand receive a high-quality, timely and appropriate level of care.
PRE-AMBLE

The aim of this guideline is to provide an educational guide and reference for radiation therapy service providers to ensure appropriate care of patients receiving stereotactic ablative radiation therapy (SABR) / stereotactic body radiation therapy (SBRT). Although reference is made to SABR/SBRT to the lung, liver and spine, the principles applied within this document can be applied to other clinical sites. However, the guideline is not meant to be a set of inflexible rules, or to be used for litigious purposes. They do not replace the clinical judgement or decisions made by the treating team.

For the purposes of this document SABR and SBRT are interchangeable and defined (as compared with conventional radiation therapy) by:

- high precision, image guided dose delivery to the target
- highly conformal dose with steep dose gradients
- larger doses per fraction (typically ≥ 8 Gy per fraction)
- fewer treatment fractions (typically 1-5 fractions)
- intra-fraction motion management where applicable.

A Tripartite Working Group was established with representation from the Faculty of Radiation Oncology (FRO) of the Royal Australian and New Zealand College of Radiologists (RANZCR), Australian Institute of Radiography (AIR), and the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM). Given the complex geography and provision of radiation therapy services in Australia and New Zealand these guidelines provide a framework with key recommendations for service providers. These guidelines have been reviewed by a panel of international experts. Feedback has been sought from the memberships of the RANZCR FRO, AIR and the ACPSEM.

Guidance has been outlined in two clear sections. The first deals with provision of services on a departmental level covering aspects of departmental staffing, equipment for patient simulation, planning and treatment, and quality assurance (QA) measures. The second deals with services on an organisation level covering aspects of trials, protocols and data collection, research and education and the establishment of networks.
INTRODUCTION

Stereotactic ablative radiation therapy (SABR)/stereotactic body radiation therapy (SBRT) refers to an external beam radiation therapy treatment that delivers a high biological dose of radiation therapy with high geometric precision to an extra-cranial target. As this is done with only one or few fractions and involves steep dose gradients, specialised planning and treatment delivery techniques are needed, with associated specific QA requirements.

The uptake of this treatment technique worldwide has been rapid. In a patterns of care survey from the United States published in 2011[1] the percentage of physicians using SABR/SBRT was 63.9%, of whom nearly half adopted it in 2008 or later. The most common sites for SABR/SBRT use were lung (89.3%), spine (67.5%) and liver (54.5%). Currently, it is not known how widespread the use of SABR/SBRT is in Australia and New Zealand, but anecdotally the number of centres using the technique is rising rapidly.

Although there is no universal consensus on the definition of what constitutes SABR/SBRT, working definitions have been adopted from the American Society of Therapeutic Radiation Oncology (ASTRO)[2], the Canadian Society of Radiation Oncology (CARO)[3] and the National Radiotherapy Implementation Group (England) [4]. What is common to all definitions is the use of high doses per fraction, small number of fractions and the requirement of specialised planning, treatment delivery and QA.

SABR/SBRT is an established treatment for early-stage peripheral lung cancer and has been shown in non-randomised studies to compare favourably to historical local control rates from conventional radiation therapy [5]. Despite it being an established treatment, data supporting its superiority to conventional radiation therapy is lacking from randomised controlled trials. The role of SABR/SBRT in the management of lung metastasis, spine metastasis and primary and secondary liver tumours is less well defined with a number of phase II and III trials either recently completed or in stages of accrual.

As the biological radiation therapy dose, the dose per fraction and the requirements on treatment precision and accuracy for SABR/SBRT are potentially more demanding than conventionally fractionated radiation therapy or intensity modulated radiation therapy (IMRT), specific guidelines are required to ensure safe practice. Practice guidelines for SABR/SBRT have been produced by a number of professional bodies but they do not necessarily take into account the specific practice requirements that exist in Australia and New Zealand. Key to delivering these treatments safely and accurately is strict QA procedures and protocols administered by a coordinated team between the Radiation Oncologist (RO), Radiation Oncology Medical Physicist (ROMP) and Radiation Therapist (RT).

This document is intended to serve as a guideline to ensure best practice in the establishment of SABR/SBRT programs and the planning and delivery of these treatments. Although the focus of the guideline is relating to treatment of lung, spine and liver, many of the principles are applicable to SABR/SBRT at other sites. Comprehensive departmental protocols should be used for each clinical site and this document should be used in conjunction with these protocols.
DEPARTMENTAL CONSIDERATIONS FOR DELIVERY OF SABR/SBRT TREATMENTS

1. DEPARTMENTAL STAFFING AND RESPONSIBILITIES

DEPARTMENTAL – GENERAL STAFFING

It is recognised that SABR/SBRT is a technically complex treatment delivery technique, and adequate multidisciplinary expertise is necessary for delivery of safe treatment. Members of all three disciplines (RO, RT and ROMP) are required for the adequate delivery of SABR/SBRT. Each discipline has both distinct and overlapping roles in the treatment planning process, treatment quality assurance, and treatment delivery. It is recommended that ongoing training and maintenance of technical skills of the relevant stakeholders should comprise a core component of an institution’s SABR/SBRT program. Best practice guidance for this treatment technique is to be carried out in an organised program. ‘One-off’ treatments by radiation multidisciplinary teams who do not specialise in the area should not be undertaken. The National Health Service (UK) practice guidelines state that “no department treating patients with SBRT should treat less than 25 patients over a year with this technique, in order to maintain the professional competences of all members of the treating team”[4]. It is recognised that a more centralised distribution of resources and larger catchment in the UK supports established, specialised institutions, nevertheless a similar number could be achieved through creating regional networks in the Australian context.

Participation in multi-institutional clinical trials and their associated quality assurance procedures is highly encouraged, as this allows for external peer review of performance. Staffing levels and staffing workloads should enable these activities.

DEPARTMENTAL – STAFFING FOR TREATMENT DELIVERY

Adequate staffing is essential for complex treatment delivery, and a high-level of oversight is required for SABR/SBRT delivery.

When introducing SABR/SBRT into clinical practice it is recommended that all three disciplines (i.e. RO, RT and ROMP) are present at the patient’s first SABR/SBRT treatment (or trial set-up, if that is used) to ensure that the patient is set-up correctly, that patient repositioning using image guidance is acceptable[4] and to directly manage any clinical issues and/or treatment related toxicities. For subsequent fractions within the same SABR/SBRT course, the RO must be present for critical decision making and otherwise immediately available.[6]

The roles and responsibilities of the treating team can be reviewed once a service has been established, an appropriate number of patients have been treated and staff training/competency assessment has been implemented. Once these are attained and as clinical skills and expertise are developed by the clinical professionals, it may be appropriate to reduce the requirement of physical presence of a RO and/or ROMP during treatment but have them immediately available to attend when required.
STAFF ROLES AND RESPONSIBILITIES

Radiation Oncologists:
The treating RO is expected to have oversight on the overall treatment regimen in terms of treatment simulation, planning and delivery. The RO is responsible for:

- Ensuring communication between and providing leadership for the treating team
- Appropriate patient selection, multidisciplinary decision making and peer review
- Prescription of dose and fractionation of the treatment regimen
- Oversight of the simulation technique and immobilization procedures
- Verifying image fusion, defining the target volumes, and defining the critical organs at risk
- Decision making regarding image-guidance and motion management strategies
- General oversight of all quality assurance processes.

For ROs, specific training in SABR/SBRT prior to performing any stereotactic procedures is required. This should include either a fellowship with SABR/SBRT experience, or attendance at a dedicated teaching course, or specific mentoring with hands on practical training.

ROs undertaking SABR/SBRT should be committed to the ongoing process of professional development to maintain knowledge and skills in SABR/SBRT.

Radiation Therapists:
RTs must maintain constant communication with ROs and ROMPs throughout the following procedures, for which they are responsible.

- Pre-simulation consultation with patient
- Positioning and immobilization
- Acquisition and registration of images
- Construction and evaluation of plan dosimetry
- Participation, consultation in and documentation of plan quality assurance in conjunction with ROMPs
- Perform image guidance procedures and assist where necessary in decision making
- Treatment delivery
- Training and mentoring of other RTs
- Participation in research and clinical trial activities based on SABR/SBRT practice
- Attendance at and contribution to regular multi-disciplinary quality assurance rounds specific to SABR/SBRT
- Contribution to regular and ongoing protocol development and enhancement.

Whilst the involvement of the RT in the SABR/SBRT process is not limited to an individual independent practitioner, it is well suited to an Advanced Practitioner role within a suitably large department. This Advanced Practitioner would oversee the RTs within the multi-disciplinary team and would be responsible for management of aspects of the SABR/SBRT program, more specifically training and credentialing of RT staff in line with formal competence based guidelines focused on the assigned procedures above and in particular Image Guided Radiation Therapy (IGRT) practice, maintenance of protocols and managing and participating...
in multi-disciplinary quality assurance rounds, trials and research activities. Institutions treating multiple sites with SABR/SBRT and significant patient loads may consider a specialist for each site if practical.

SABR/SBRT treatment delivery should be performed by properly trained RTs who have undergone specific training for this technique and meet a specified competence level in particular relation to IGRT. No less than 2 RTs should deliver any SABR/SBRT treatment.

Specific training for RTs may be undertaken at a dedicated teaching course and/or in-house training with mentoring by other members of the multi-disciplinary team who have established specialist knowledge and expertise in SABR/SBRT.

Radiation Oncology Medical Physicists (ROMPs):

In establishing and supporting a SABR/SBRT program, additional physics resources (personnel, hardware and software) will be required for development, implementation and ongoing management of quality and safety of treatments.

- A certified ROMP or equivalent, as defined by the ACPSEM, must have a leading role in the development of each clinical technique, its implementation into a department, ongoing clinical physics support and quality improvement.
- A certified ROMP or equivalent, as defined by the ACPSEM, must be responsible for the SBRT quality assurance program.
- The ROMP must have extensive knowledge of treatment planning and complex treatment delivery issues that are unique to SABR/SBRT. This includes but is not limited to the use of multimodality imaging for volume definitions, imaging for patient positioning and treatment verification, the dose calculation and optimisation algorithms used by the treatment planning system, the treatment delivery system and its limitations.
- In addition it is recommended that further SABR/SBRT specific training course be undertaken from an appropriate training provider.
- The ROMP should, in consultation with the RO and RT, develop a comprehensive, multi-disciplinary risk assessment of the clinical implementation of SABR/SBRT in their centre; this should form the basis for the development of the QA program and patient pathway.
- Demonstrated participation in continued professional development by the certified ROMP (ACPSEM CPD System) is mandatory.
2. DEPARTMENTAL PROCEDURES AND EQUIPMENT

PROCEDURES PRIOR TO RADIATION THERAPY PLANNING

Given the highly conformal nature of these treatments it is imperative that a patient being considered for SABR/SBRT has the most appropriate imaging to enable accuracy in target delineation. This may include but is not limited to high resolution magnetic resonance imaging (MRI) or CT scans and/or CT/Positron emission tomography (PET). If specific imaging sequences are required, the imaging team should be instructed directly. If fiducial marker implantation is part of the department’s motion management procedure, they should be implanted into or near the target prior to simulation either by a radiologist or in the case of lung tumours, an interventional bronchoscopist. Given the various types of fiducial markers available for use it is important that there is appropriate engagement of radiology services to provide this service. Any anatomical/functional imaging should be performed at a similar time to radiation therapy planning with the patient immobilised in the simulation/treatment position if possible.

Given the longer simulation and treatment times that may be involved with SABR/SBRT, patient symptoms and co-morbidities should warrant particular consideration prior to planning. Any pain or discomfort should be managed with analgesia prior to simulation and consideration given to methods of relaxation or anxiolytics in patients who find maintaining the required planning/treatment position difficult and/or experience anxiety. If tumour and organ motion are thought to be a significant factor then consideration should also be given to the type of immobilisation to be used and to the patient’s respiratory stability and whether this is likely to deteriorate during the planning and treatment process.

As the planning procedures for SABR/SBRT are different to other forms of radiation therapy treatment it is recommended that patients have access to specific written information regarding the nature of the treatment. A pre-planning checklist may be useful on the day at the time of simulation to ensure these key issues are addressed prior to commencing the patient positioning.

SIMULATION PROCEDURES

Given the nature of SABR/SBRT treatment, patient stability for planning and subsequent treatment is paramount. It is recommended that the entire length of the patient be supported comfortably and effectively. Indexed patient positioning systems that ensure consistent patient positioning throughout the planning, simulation and treatment chain are recommended.

Adequate immobilisation is required for SABR/SBRT delivery. Stabilisation and immobilisation options should be considered at the time of simulation and will vary dependent on the site of SABR/SBRT (e.g., lung, liver or spine) and location of the treatment (cervical, thoracic or lumbar spine). As such a department delivering SABR/SBRT should have a range of immobilisation devices to account for these situations. Customised supports such as vacuum bags should be available and are recommended in the treatment of lung, liver and spine SABR/SBRT [7-9]. Commercially available ‘standard’ head and neck, knee and foot supports may also be used. Due to the possible extended treatment times patient comfort is paramount. Therefore in some circumstances arm positioning and support needs to be considered with reference to potential beam or arc placement.

Other specialised immobilisation systems may also be considered including but not limited to:

- Evacuated drapes
- Abdominal compression
Due to the generally smaller targets with SABR/SBRT techniques, CT planning slice thickness of 1-3mm (≤2mm is desirable) through the tumour site is recommended for most clinical cases\(^9\). Particularly for liver and lung SABR/SBRT, tumour motion assessment must be accounted for at simulation. Four dimensional computed tomography (4DCT) simulation is recommended for lung and liver SABR/SBRT simulation and allows:

- assessment of the range and nature of tumour motion
- acquisition and binning of the respiratory cycle into the various phases
- accuracy in defining the target so as to minimise margins.

It is important to note that image quality in 4DCT will be very much related to the patient’s ability to maintain a steady and consistent respiratory pattern. Respiratory coaching methods can be utilised to enable a patient to achieve stable breathing where they cannot do so initially. Coaching can be facilitated in a variety of ways including a staff-assisted dry run prior to the CT scan, use of a training video or information sheet, or utilisation of video and/or audio feedback displayed prior to and during imaging and treatment.

Although motion management is beyond the scope of this document, it is an essential part of the planning, simulation and treatment of SABR/SBRT. For any department undertaking SABR/SBRT a motion management plan is an essential part of delivering these treatments, as outlined in the American Association of Physicists in Medicine (AAPM) Task Group Report 76\(^{10}\).

**PLANNING PROCEDURES**

The planning for SABR/SBRT often requires multimodality image fusion. Therefore, image registration and fusion capability are essential to be able to link the various data sets used in planning. A detailed assessment of appropriate imaging in the radiotherapeutic management of patients with cancer is discussed in ‘Imaging in Radiation Oncology - a RANZCR Consensus White Paper’\(^{11}\).

The treatment planning system (TPS) should enable a range of planning options that include static beams, dynamic arcs and intensity modulated beams or arcs and combinations of same. The TPS should include at least a superposition/convolution type dose algorithm and/or a Monte Carlo dose algorithm, particularly where beams will traverse interfaces between tissues of significant variation in their electron densities (including lung and bone).

Dose prescriptions in SABR/SBRT are often specified at low isodoses (eg ≤ 80% isodose) with small or no margins for beam penumbra at the target edge. Hot spots within the target volumes are generally viewed to be clinically desirable, as long as there is no spillage into normal tissue. The use of multiple non-opposing beams (including non-coplanar beams) may help to achieve the sharp dose fall-off required in SABR/SBRT applications. Modulated arc plans may also be helpful in achieving appropriate dose distributions that can be delivered efficiently.

**TREATMENT**

Within Australia and New Zealand, treatment systems used to deliver SABR/SBRT include linear accelerators (linacs), Tomotherapy and Cyberknife units. Each will possess advantages and disadvantages that are well described in National Radiotherapy Implementation Group (NRIG) UK guidelines\(^3\), Canadian Association of Radiation Oncology (CARO) guidelines\(^4\) and TG101-SBRT AAPM guidelines\(^{12}\).

To deliver the high doses per fraction involved in SABR/SBRT image guidance capability should be carefully considered. The ability to have online correction and evaluation and correction for intra-fraction errors is a minimum standard. Therefore an effective image guidance system will have capabilities for volumetric or stereoscopic imaging that provides 3D information on target
and Organ At Risk (OAR) positions, real time or near “real time” imaging capability to enable on-line correction and the ability to image intra-fractionally due to long treatment times. Imaging technology is evolving rapidly and systems already include MV and kV cone beam CT (CBCT), linac and/or Tomotherapy units, gated CBCT, stereoscopic planar imaging and potential for digital tomosynthesis in the future. To ensure a safe SABR/SBRT program, well defined imaging protocols that include consideration of tolerances, action levels and frequency of imaging both intra and inter fractionally should be adhered to.

The treatment delivery unit itself should meet the AAPM TG101 tolerances on linear accelerator performance including the following: high degree of accuracy of mechanical rotation around the isocentre (<2mm diameter), ability to deliver high dose rates, and an effective means of monitoring patient stability during treatment. Many clinical sites will also benefit from beam modulation, 6 degree of freedom couch correction and patient respiration monitoring equipment. As most SABR/SBRT applications use multileaf collimator (MLC) collimation, a ≤ 5mm MLC leaf width is required for most applications [12].

Contingency plans should be given to treatment delivery redundancy, such that in the event of catastrophic machine breakdown SABR/SBRT treatment courses would be completed. This should be incorporated into risk management and contingency planning at the planning stages.

3. DEPARTMENTAL QUALITY ASSURANCE MEASURES

GENERAL

It is recommended that any department undertaking SABR/SBRT utilises peer reviewed and evidence based protocols that are regularly reviewed and date tracked. Serious complications using these techniques have been reported [11] and strategies should be employed to mitigate these, in order to achieve a good patient outcome.

Key factors to reduce the risk of serious adverse events include, but are not limited to [12]:

- Appropriate patient selection for SABR/SBRT treatment as per the clinical site
- Appropriate dose and fractionation schedule specific for the clinical site and location or the tumour
- Accuracy in target delineation
- Extensive OAR delineation with dose constraints based on evidence base practice
- Consideration given to any previous treatment with radiation therapy at that site
- Peer review and stringent QA at every stage of planning and treatment.

These factors are best discussed for each individual patient in a peer review forum prior to the commencement of treatment, with appropriate documentation of any important recommendations or changes. Databases linking patient treatment parameters, dosimetry and outcome are encouraged to ensure ongoing quality assurance.

DOSE REPORTING REQUIREMENTS

There is currently no internationally accepted method to report dose for SBRT. It is acknowledged that there are significant differences in planning these treatments and consequently dosimetry differs. To optimise rapid dose reduction away from the target the covering dose is often ≤ 80% isodose. The maximum dose within the target is often much higher (in some cases this can be in excess of 150% of the covering dose or prescription dose). Therefore dose uniformity is a less important consideration and less achievable.
Although International Commission on Radiation Units and Measurements (ICRU) guidelines for SBRT reporting are currently under development, until such time that they become available a minimum set of reporting requirements for departments should include the following:

- Planning Target Volume (PTV): Dmax, D95, D98
- Gross Tumor Volume (GTV): Dmax, D99
- OAR: Site Specific.

The reportable maximum and minimum doses to targets and OARs should be to a defined volume that will be dependent on the dose grid size used in the treatment planning system and the dose calculation algorithm used.

**QUALITY ASSURANCE MEASURES**

In planning of SABR/SBRT often other image modalities are used in the planning process. Therefore the quality and integrity of these images and the accuracy of the image fusion process need to be evaluated. The planning CT slice thickness should be no more than 3mm (whilst ≤2mm is desirable).

For treatment planning, the TPS requires a minimum grid resolution of 2mm. Treatment planning systems used for SABR/SBRT should use an advanced photon dose-calculation method based on Monte Carlo pre-calculated dose-spread kernels and employing convolution/superposition techniques \[^{13}\]. However, the limitation of any planning system for small and inhomogeneous fields needs careful consideration.

As for all complex radiation therapy treatments, individual patient QA should occur prior to treatment. At a minimum this should include a relative and absolute measurement and calculation performed prior to treatment with adequate time to amend the plan if required. This may be reviewed after a local risk assessment and sufficient clinical experience has been achieved such that a process based QA programme may be established as an alternative.

Quality assurance procedures at the treatment machine should include all routine procedures, as well as (but not limited to) the following:

- fluence measurement with Electronic Portal Imaging Device (EPID), or equivalent to check the MLC delivery pattern
- where arcs have been planned, clearance on the treatment unit should be checked, particularly where couch angles off 0 degrees are used
- for image guidance, projection angles, marker/fiducial definition and artefact from same or from surgical clips etc, should all be considered as part of the overall commissioning and QA procedures.

An on-site external audit and review of processes prior to commencing an SBRT program per clinical site is strongly recommended. The scope of this includes:

- Review of imaging, treatment planning and treatment processes per clinical site
- Review of equipment used, QA program and tolerances
- Observation of end-to-end (Level 1,2) dosimetry performed with phantom geometry conditions approaching reality as close as possible (ie moving targets, small fields, inhomogeneity).

Although no group currently offers external audit of SABR/SBRT implementation, the physics quality assurance could be undertaken by an institution with experience in that clinical site. The audit could also be undertaken as credentialing for a particular study by a clinical trials organisation. However, this is likely to be clinical site specific and not comprehensive to cover all aspects of SABR/SBRT QA for all of the clinical sites.
ORGANISATIONAL CONSIDERATIONS
FOR DELIVERY OF SABR/SBRT TREATMENTS

1. DELIVERY OF SABR/SBRT SERVICES AND NETWORKS

In this section of the guidelines we address issues particular to Australian and New Zealand centres wishing to implement SABR/SBRT, with relatively low caseloads of patients, and/or those that are geographically isolated from experienced SBRT/SABR centres.

In comparison with many international centres, Australian and New Zealand centres tend to be small with the majority having between 2-5 linear accelerators. This poses particular issues in terms of the development of specialist expertise in SABR/SBRT. The treatment requires intensive efforts by medical physicists and radiation therapists to develop the technical infrastructure and protocols required for safe planning and delivery, particularly during the early implementation phase. This is highly resource intensive, and given the relatively small size of centres in Australia/New Zealand, it means that these efforts are likely to benefit only a relatively small number of patients. In international guidelines, such as the NRIG guidelines from the United Kingdom, a minimum departmental caseload of 25 per annum is specified,[4] this would not be achievable by the majority of Australasian radiation therapy departments. Restricting SABR/SBRT to high volume radiation therapy centres may also exacerbate radiation therapy access concerns, which is already faced by patients in regional and remote communities.[14] Furthermore, there is a risk that centres in any setting implementing SABR/SBRT without external guidance and support may develop inadequate processes for the safe delivery of SABR/SBRT treatment.

Australian and New Zealand centres require innovative approaches to streamline the education and training of radiation therapy staff delivering SABR/SBRT, and to make the complex quality assurance required feasible. As such it is recommended that centres implementing SABR/SBRT actively seek collaborations with more experienced centres. This process of collaboration may be enabled by the development of clinical trials and formal networks to support the clinical, technical and data collection needs for SABR/SBRT departments.

Processes which may help to facilitate the safe implementation of SABR/SBRT include:

- Standardisation of technical and clinical protocols at a state or national level
- Formal processes to audit technical quality assurance
- State or nationally based data collection through the development of registries to formally document disease control and toxicity outcomes
- Participation in multicentre clinical trials with centralised quality assurance and peer review and/or credentialing mechanisms
- Consideration of institutional credentialing.
2. MAINTENANCE OF EXPERTISE

In the absence of large caseload innovative approaches to maintaining skills in SABR are required. Ongoing case review with individual case discussion and documentation, which could usefully be performed at a network level, would support clinicians responsible for SABR/SBRT treatment. The development and maintenance of skills in plan evaluation and IGRT skills could also be assessed by the development of credentialing and audit processes.

Given the paucity of high-level evidence for the efficacy of SABR/SBRT in all clinical sites, enrolment in clinical trials is recommended. It is recognised that clinical trials are associated with significant costs and additional administration. The additional imposts associated with collaborative trials may prevent many individual centres from trial participation. However, the rigorous quality assurance and auditing processes proposed above, coupled with network level support for trial participation may help to overcome this problem. Therefore departmental participation in trials, where available, is strongly encouraged. The development of network level trial coordination centres to streamline the processes of ethical approval and data collection may reduce the onerous administrative burden on small radiation therapy centres. In the absence of multi-institutional clinical trials, treatment using institutional clinical protocols are necessary to assist in standardisation of treatment delivery should be practiced.
KEY RECOMMENDATIONS

1. Departmental staffing recognises that SABR/SBRT is an advanced radiation therapy planning and delivery technique that requires a multidisciplinary input from RO, RT and ROMPs. These team members require high level expertise with defined roles and responsibilities to ensure high quality treatment. It is strongly recommended that all individuals involved in SABR/SBRT treatments receive SABR/SBRT specific training.

2. Departments must have clearly documented procedures and protocols for simulation and planning SABR/SBRT treatments. It is strongly recommended that site-specific protocols be developed prior to starting an SABR/SBRT program.

3. Specialised equipment for immobilisation is required as too is the ability to manage motion for targets affected by respiratory excursion. Delivery units should meet strict requirements to deliver these treatments as outlined in the document.

4. Departmental quality assurance procedures and protocols should be documented and meet existing national and international guidelines. Consideration should be given to individual case audits as part of development of a credentialing process.

5. For education, training and delivery of SABR/SBRT, regional networks should be established with an emphasis on maintenance of expertise, quality assurance, collection of data and trial participation.
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