



ECIO 2013

**Fourth European Conference
on Interventional Oncology**

The Review

**June 19-22
Budapest | Hungary**

The background of the advertisement is a photograph of a lush green park. In the foreground, there are bamboo stalks and leaves. In the middle ground, several people are sitting on a wooden bench, looking towards a pond. In the background, more people are walking along a path. The Siemens logo is in the top left corner.

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The ECIO 2013 Review

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Impressum

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Graphics: L O O P . E N T E R P R I S E S media, www.loop-enterprises.com

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From Thermal Springs to Thermal Ablation: ECIO Goes to Budapest

At last year's congress, it was announced that ECIO would move from a biennial event to an annual one. 2013 saw the first proper annual occurrence of ECIO, held in June rather than April, due to other fixtures in the CIRSE calendar.

Nevertheless, the meeting proved hugely popular, with over 900 participants from 60 countries making the journey to Budapest in high summer. Despite the incredible heat outdoors, the congress centre was ideal for ECIO's needs, providing a cool and comfortable environment in which to explore the world of interventional oncology.

Multidisciplinary approach

To help accommodate the multi-faceted nature of oncological care and support the clinical aspects of interventional oncology, a new series of multidisciplinary tumour boards was introduced. These included the discussion of clinical cases, with the aim of developing clinical practice guidelines and treatment recommendations.

The *ECIO meets...* sessions again featured prominently, joining forces with the International Liver Cancer Association (ILCA), the World Conference on Interventional Oncology (WCIO) and, for the first time, the European Society for Radiotherapy and Oncology (ESTRO).

This inter-disciplinarity was helped in part by the 'Bring Your Referring Physician' programme, which offers free registration to non-radiologist colleagues and is now in its third year.

Variety of formats

The meeting offered a wide range of session types. Alongside standard sessions and the new tumour boards, several panel discussions were timetabled in. Interactive hands-on workshops covering image-guided tumour ablation in a variety of organs were offered, as were interactive sessions devoted to the management of complications. New to the programme was a series of *How I do it: tips and tricks from the experts* sessions, where leading experts shared their experience with important interventions, including transcatheter oncology procedures and image-guided ablation.



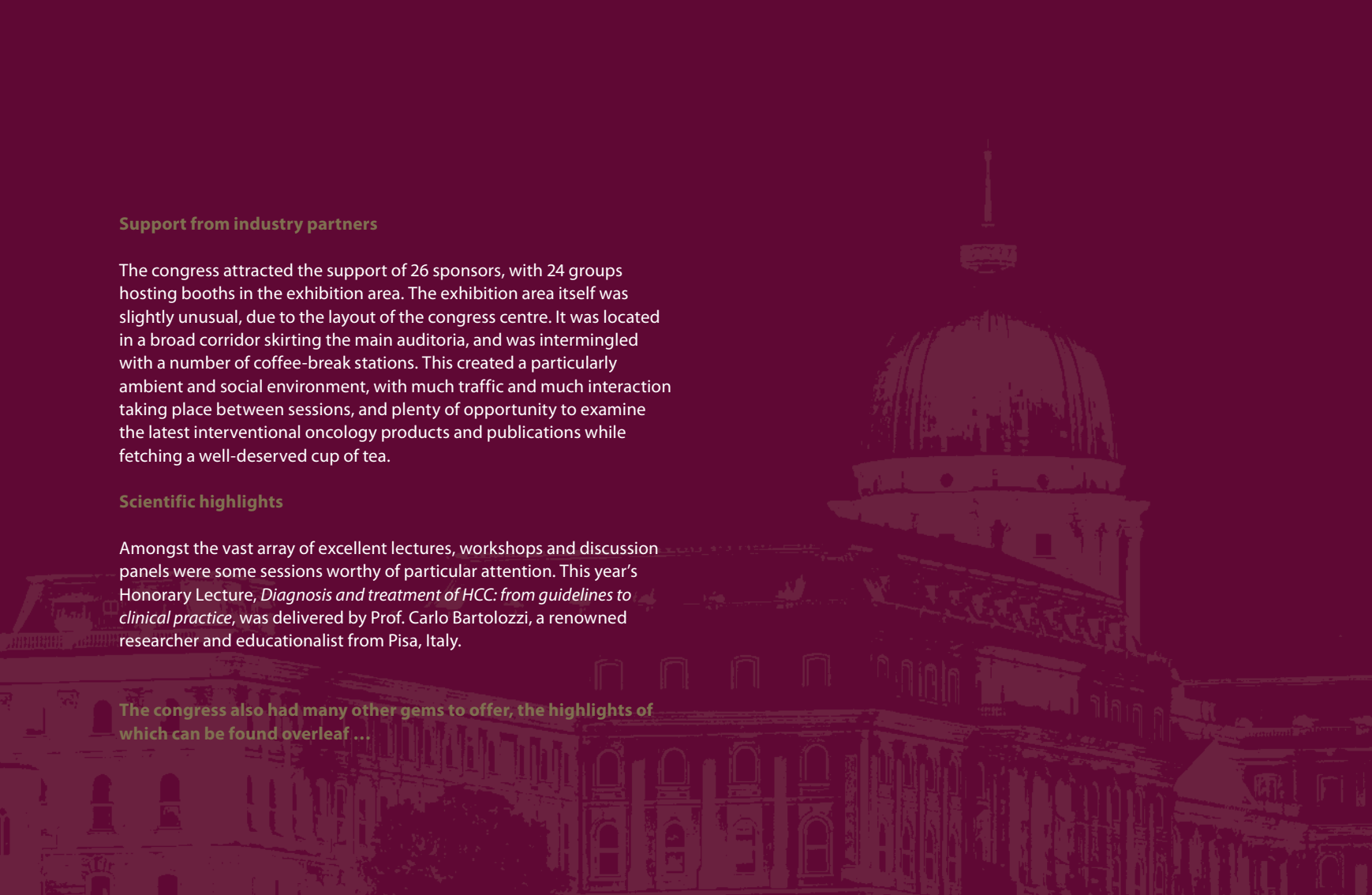
Support from industry partners

The congress attracted the support of 26 sponsors, with 24 groups hosting booths in the exhibition area. The exhibition area itself was slightly unusual, due to the layout of the congress centre. It was located in a broad corridor skirting the main auditoria, and was intermingled with a number of coffee-break stations. This created a particularly ambient and social environment, with much traffic and much interaction taking place between sessions, and plenty of opportunity to examine the latest interventional oncology products and publications while fetching a well-deserved cup of tea.

Scientific highlights

Amongst the vast array of excellent lectures, workshops and discussion panels were some sessions worthy of particular attention. This year's Honorary Lecture, *Diagnosis and treatment of HCC: from guidelines to clinical practice*, was delivered by Prof. Carlo Bartolozzi, a renowned researcher and educationalist from Pisa, Italy.

The congress also had many other gems to offer, the highlights of which can be found overleaf ...



New therapy innovations

Interventional oncology is a dynamic discipline, with continual innovation leading to new therapeutic approaches. A number of up-and-coming therapies were discussed at this year's meeting, showing the latest data to support their use.

Chemosaturation for treatment of hepatic metastases

Dr. Charles Nutting (Engelwood, CO/US) introduced the concept of chemosaturation for hepatic metastases of ocular melanoma. 3,500-4,000 ocular melanoma diagnoses are made in the USA annually, and about half will have metastases (80% in the liver). The liver is often studded with disease, and contrast-enhanced MRI is useful for thorough investigation.

Hepatic chemosaturation allows whole-liver treatment with minimal systemic impact. It is a 3-in-1 procedure, where the liver is isolated (via balloon occlusion), saturated with high-dose chemotherapy agents, and the blood is then filtered extracorporeally before being returned to the circulatory system. This allows dosing levels 10 times higher than usually achievable.

Dr. Nutting's trial has treated 93 patients, with percutaneous hepatic perfusion vs. best alternative care. Excellent results have led to an expanded access protocol for ocular melanoma in the USA, using second generation filters.

Oncolytic viruses

The promising field of oncolytic viruses was explained by Dr. Rick Patt (New York, NY/US), where modified viruses preferentially replicate within cancer cells, leading to lysis while sparing normal cells.

Dr. Patt's team are investigating the use of JX-594 (Pexa-Vex), which has a demonstrated safety profile and has been modified by inserting genes for TK disruption, lac-Z (for monitoring) and GM-CSF. Treatment of over 200 HCC and ovarian cancer patients has demonstrated not only safety, but a triple efficacy, achieving cell lysis, active immunotherapy and tumour vascular ablation.

Multiple delivery methods are possible, but best results seem to have been achieved by a three-stage approach, utilising a primary intravenous dosage, followed by direct delivery and a therapeutic booster. The therapy is highly cancer-specific, is well tolerated and has no on-going safety issues.

Irreversible Electroporation

IRE has been under investigation for several years, primarily in the liver, and Dr. Govindarajan Narayanan (Miami, FL/US) presented his results for its use in pancreatic cancer.



IRE is a focal non-thermal ablative therapy, using high voltage, low energy DC electrical pulses to permanently open cell membranes. It has not replaced other modalities in his hospital, but expands possibilities and complements RFA and MWA. Its main advantage is the lack of associated heat-sink, and its preservation of vessel patency. Dr. Narayanan's pancreatic series (see page 8) has shown safety and efficacy, and he advises use of multiple probes to achieve an adequate margin.

High-intensity Focused Ultrasound (HIFU)

Dr. Franco Orsi (Milan/IT) discussed the use of HIFU, which can be MR- or US-guided. This non-invasive therapy creates an acoustic focal point, where temperatures are sufficient to cause cavitation and coagulation necrosis.

The therapy is best suited for small lesions, does not rule out other options, and broadens clinical indications due to its reduced invasiveness. The current areas of most clinical interest are breast cancer, uterine fibroids and pancreatic cancer (where it shows evidence of a survival benefit). Contrast-enhanced US is showing promise in performing HIFU, providing instant feedback on efficacy, enhancing US tissue impedance, and needing lower power and shorter treatment time. This overcomes many of the disadvantages of plain US-guidance, reducing the need for repeat treatment and helping to overcome the limitations of patient fat.

Nanotechnology

The principles and applications of nanotechnology were explained by Dr. Sarah White (Wisconsin/US). Their minute size makes nanoparticles useful for cellular imaging, traversal or interaction.

Multiple platforms are available, with different structures (liposome, dendrimer, gold nanoshell, etc.) and uses (e.g. gene or drug delivery, screening, detection). As the hallmarks of cancer include enhanced permeability and retention (EPR) effect, nanoparticles preferentially accumulate in tumours. If engineered appropriately, they can also be visualised and monitored.

Trials are currently investigating eleven different particles, and therapies such as nanoembolisation may enhance sorafenib uptake, overcoming several limitations (orally toxic, hydrophobic). Similarly, combining nanotherapy and electroporation (to achieve temporary membrane disruption) may achieve good results. Photothermal ablation (infra-red laser) is another avenue for exploration.

Dr. White and her colleagues at Northwestern are currently developing multifunctional nanoparticles, combining molecular MRI contrast, a photothermal sensitiser and tumour-specific targeting.

IR is uniquely placed to deliver these therapies, and trial results are eagerly awaited.

Thermally sensitive doxorubicin carriers

A method of utilising sub-lethal heating created during thermal ablation was described by Prof. Riccardo Lencioni (Pisa/IT). Sub-lethal heating ($<50^{\circ}\text{C}$) is associated with several phenomena, such as increased blood flow, increased vascular permeability and effects on multiple cell targets.

In adding doxorubicin to an ablation zone, additional coagulation is achieved, with a 415% increase in ablation volumes. If doxorubicin is loaded into a liposomal membrane which collapses when heated to above 39°C , it can be preferentially delivered to the ablation zone, including the periphery. This has been examined in the HEAT trial, among others. Although the trial did not meet its primary endpoint, post-hoc analysis shows that the relationship between the heating cycle and the release of doxorubicin is worthy of investigation, as data indicates this could increase efficacy.

Tumour metabolism

The mechanisms of tumour metabolism and possible pathways for interruption were explained by both Prof. Jeff Geschwind (Baltimore, MD/US) in the *New Horizons* session, and by Dr. Terence Gade (Pennsylvania, PA/US) in the *ECIO meets the WCIO* session (top right).



Dr. Gade gave a general introduction, explaining the molecular mechanisms of chemoembolisation and challenge of TACE-induced hypoxia. HCC cells are able to survive sustained TAE-like ischaemia, due to a variety of molecular pathways, including the hypoxia inducible factors (HIFs), the unfolded protein response (UPR), and autophagy. HIFs play a critical role in the adaptation of proliferating cells to hypoxia by modulating metabolism, angiogenesis, growth and metastasis.



Dr. Gade also explained possible methods to interrupt these metabolic pathways (such as targeting autophagy with Chloroquine), and to identify functional biomarkers of response to TACE (such as dynamic nuclear polarisation), as well as his team's investigations with cell perfusion and cellular bioenergetics under ischaemia.

Prof. Geschwind's lecture also addressed the basic principles of gene functions and the relationship between hypoxia (anaerobic glycolysis) and tumour size. His team at Johns Hopkins began working to exploit the increased demand for glucose in such cancerous cells 13 years ago, and has identified Bromopyruvate as a suitable agent.

The agent has inbuilt imaging biomarkers (for FDG-PET imaging) and does not require encapsulation, as it can be delivered intra-arterially for the liver, and percutaneously elsewhere. Rabbit models show complete tumour kill and lack of toxicity, as well as curative response when the cancer is limited to the liver. As glycolysis is a common pathway to upwards of 90% of tumours, this is an exciting new frontier.

IO meets radiation oncology

Dr. Nisita Kothary (Stanford/US), explained the possibilities introduced by SBRT, which opens new opportunities for both patients and IRs. IR's main involvement will be in the percutaneous placement of fiducials (e.g. coils

or stents), to enable precise dosing despite the variation of the tumour position during the respiratory cycle.

IR can also be used synergistically for large tumours (e.g. chemoembolisation + SBRT), expanding therapeutic horizons. In other cases (e.g. advanced lung cancers), SBRT represents direct competition: tumour control appears to be better for SBRT (although patient cohorts are different), but survival rates for RFA are similar, with lower costs and toxicity. As such, it is difficult to say which therapy is superior, and IR should pursue research and innovation to ensure that the correct indications are found for these patients.



Presentations are available at www.esir.org

New clinical applications

Parallel to the discovery of new techniques and therapies, progress is being made in finding new clinical applications for existing or new technologies. Many of these fill a much-needed gap, treating cancer types and presentations that are unsuitable for existing therapeutic options. These new investigative frontiers were addressed in a number of sessions, namely the dedicated *New clinical applications in image-guided ablation session*.

Pancreatic cancer

Opening the session was Dr. Govindarajan Narayanan (Miami, FL/US), who presented his ground-breaking work in treating pancreatic cancer.

Pancreatic cancer has the highest case-fatality rate of all cancers. Surgery obtains good results, but only 10-20% of patients will be eligible. Currently, Folfirinox is the first-line treatment, but has significant side-effects and is poorly tolerated by patients.

RFA and MWA were tried with limited success and a high complication rate, but new IRE technology offers an opportunity to ablate tumours without a heat-sink effect. Damage is caused, but repairs quickly.

An initial study on percutaneous IRE for downstaging in 14 patients was published in JVIR in 2012, with an additional 16 patients treated



subsequently. Results show that the procedure is well tolerated, and achieves better response in LAPC tumours than in metastases. At least 3 needles are needed, and care must be taken regarding placement (parallel), spacing and organ traverse. Not all patients are suitable, but early data suggests that IRE is both safe and effective in many LAPC patients, who may have no other treatment options left.



Breast cancer

With the introduction of breast cancer screening programmes, smaller tumours are frequently diagnosed, enabling breast-conservative treatment. Dr. Jean Palussière (Bordeaux/FR) examined the options for minimally invasive breast treatment. Increasing life expectancy is leading to a more elderly patient population, who frequently have co-morbidities that rule out conservative treatment.

It has been noted that elderly patients present certain characteristics that are favourable to thermal ablation. Their tumours are often completely embedded in fat, due to gland involution, which increases the temperature at the tumour margins.

In a study publishing in 2012, Palussière and colleagues treated 21 patients over 70 who refused surgery, with tumours <3 cm, at least 1 cm from skin, nipple or chest wall, generally performed under US-guidance. CT was also used, but the tumours were generally difficult to penetrate, and are easier to visualise on other modalities. At 1-year follow-up of 20 patients, complications included four spontaneously healing skin burns, and three nipple retractions. RFA demonstrates good long-term efficacy, especially in elderly patients, and MRI is mandatory for follow-up.

Other possibilities for treating breast cancer include cryoablation for large lesions that are close to the skin, and MRgHIFU, which could expand the indications for treatment.

Prostate cancer

Prof. Afshin Gangi (Strasbourg/FR) discussed cryoablation for prostate cancer, the most prevalent cancer in men. When performed under trans-rectal US-guidance, percutaneous prostate cryoablation faces the limitation of poor visualisation of the ablated zone, due to the angle-shadowing effect of the ice ball. Prof. Gangi's team thus investigated the technical feasibility of transperineal prostate cryoablation under MR-guidance.

MR was found to offer real-time visualisation of the complete circumference of the ice ball and non-invasive real-time MR temperature mapping, while use of MR-compatible fiberoptic thermosensors allowed for temperature monitoring and thermal protection (i.e anterior rectal wall, neurovascular bundle).

However, MR-guidance entails several disadvantages, not least a long learning curve, the need for non-ferromagnetic instrumentation and more difficult access to the patient (and difficulties treating large patients). Moreover, it entails a relatively long procedure time, particularly with a free-hand technique.

Early data seem encouraging, although very advanced operator skills are needed, and dedicated instrumentation and leg-inserts would be advantageous. Further advances in software, hardware and robotics may reduce procedure time and difficulty. Prostate cryoablation using MR-guidance is technically feasible and opens the way to the focal treatment of prostate cancer under MR-guidance.

Thyroid nodules

The possibilities for treating benign thyroid nodules were addressed by Dr. Jung Hwan Baek (Seoul/KR). Dr Baek discussed patient selection, and the three indications for treatment – symptomatic problems, cosmetic problems and hyperfunction. Dr. Baek's team carried out a study comparing EA with RFA as a first-line treatment for benign thyroid nodules.

Their 2013 paper demonstrated that for cystic thyroid nodules, ethanol ablation should be preferred, as it is marginally more effective, and entails fewer treatment sessions and lower costs. Unsatisfactory results were achieved with EA in 26% of predominantly cystic patients, but when additional RFA was performed, a 92% volume reduction was achieved. For solid nodules, RFA is vastly more effective. Their research also showed that RFA obtains better results than laser ablation for solid tumours.

To minimise damage during RFA, congenital vagus nerve variations must be considered, and hydrodissection can be used to displace nerves. Of the 3.3% of complications noted, haematoma and voice change were the most common, with one case of Horner Syndrome after RFA due to cervical sympathetic ganglion damage.

Adrenal ablation

Dr. Alice Gillams (London/UK) presented her experiences of adrenal tumour ablation. As well as describing correct procedural set-up (GA or conscious sedation; CT fluoroscopy; decubitus or prone positioning; generally retroperitoneal paraspinal approach) she also discussed potential complications, and the principles behind them.

With adrenal cryoablation, hypertension occurs during thawing, with a hypertensive crisis normally presenting during the active part of the second thawing cycle. This occurs secondary to epinephrine and norepinephrine release from healthy adrenal tissue, with significantly higher systolic pressures during adrenal ablation, compared with renal ablation. Thus, routine alfablockading is recommended for cryo-ablation, orally administered for 10-14 days prior to the procedure.



For ‘hot’ ablation, there is no need for an alphablock, as hypotension can also be a problem, and intra-arterial monitoring is mandatory throughout the procedure, with any hypertension being treated intra-procedurally. Temporarily interrupting the ablation is also an option.

Small series using RFA to treat aldosteronoma, small secretory adenoma and Cushing’s syndrome have achieved promising results. These indicate that ablation is a suitable alternative to surgery, especially for Cushingoid patients, entailing shorter hospital stays.

Adrenal metastases are often a marker for advanced disease, so local ablation has limited value, but should be offered to those with established isolated, metachronous, small adrenal metastases.

Renal embolisation in 2013

Speaking during the *ECIO meets the WCIO* session, Prof. Ricardo Garcia-Monaco discussed the current indications for renal embolisation. Renal cancers account for 4% of all cancers, but 2% of overall cancer mortality. 70% of lesions currently identified are small renal masses, and appear as incidental findings.

Radical nephrectomy (RN) is the gold-standard option. Pre-operative embolisation using particles or glue can be performed for large tumours, facilitating a reduction of intra-operative blood loss, better cleavage to the tumour, tumour devascularisation and better pedicle approach. The literature on pre-operative embolisation is controversial, but most urologists claim that it is helpful in select cases (e.g. >9 cm).

For small tumours, RN is technically straightforward, but increases the risk of chronic kidney disease and cardiovascular events. Thus, partial nephrectomy (nephron-sparing surgery or NSS) is becoming more widely used, and can be performed as an open procedure, laparotically or robotically. It is technically more difficult, as renal cell carcinoma is highly vascularised, and vascular clamping (warm ischaemia time) can lead to loss of renal function. Pre-operative embolisation decreases the warm ischaemia time, as well as achieving bleeding control, allowing the tumour to be removed without clamping.

RFA/embolisation may also be useful for unresectable tumours or poor surgical candidates with disseminated disease, providing these patients with a better quality of life.

All presentations can be viewed at www.esir.org

New advances in image guidance

The cornerstone of interventional oncology (IO) is advanced image guidance, which enables the effective planning and execution of minimally invasive procedures.

While imaging technologies featured across many sessions, the following lecturers covered some of the latest developments in imaging techniques and technologies, and assessed how these are improving accuracy of treatment within a range of IO applications.

Cone-beam CT

After providing a technical outline of how cone-beam CT (CBCT) works, Dr. M. van Strijen (Nieuwegein/NL) explained the uses and corresponding advantages and limitations of the technology.

This new interventional technique has applications in the guidance of both diagnostic biopsy and needle intervention treatments such as tumour ablation. The importance of radiation dose was addressed, with a summary of published data showing a considerable dose reduction with CBCT guidance when compared to CT guidance in selected body parts.

CBCT brings increased accuracy in image guidance and overall results of its use so far have been promising with a high technical success rate.



Fusion imaging

Dr. Bradford Wood (Bethesda, MD/US) began his presentation by raising the question of how interventions might be optimised by making best use of all the available radiological information.

Fusion imaging was presented as a way to do this, being useful in meeting the challenge of ensuring complete tumour treatment during ablation procedures as the areas of tumour yet to be treated can be seen during treatment.



The advantages of image fusion include a real-time reference, the simplification of complex spatial relationships, and the visualisation of otherwise hidden lesions. Use of fusion imaging in prostate biopsy has been seen to double the cancer detection rate.

This technique has real value within the therapeutic armamentarium and the current barriers to its wider adoption, namely cost and complexity, are likely to decrease with time.

Contrast-enhanced ultrasound

Although CEUS is more complex and expensive than classic ultrasound, Dr. Hippocrates Moschouris (Piraeus/GR) explained how it offers enhanced detection of lesions which would be invisible on plain ultrasound. Real-time visualisation of tumour perfusion and distinction between viable and necrotic tissues is possible, enabling superior targeting. This in turn means fewer treatment sessions with associated cost savings and increased patient convenience.

Applications of CEUS guidance in IO include liver tumour biopsy and ablation. Illustrative examples of these were shown, highlighting the technical application of CEUS in preprocedural planning and intraprocedural guidance. Although less well established, the role of CEUS guidance in transarterial chemoembolisation is also promising.

MR imaging

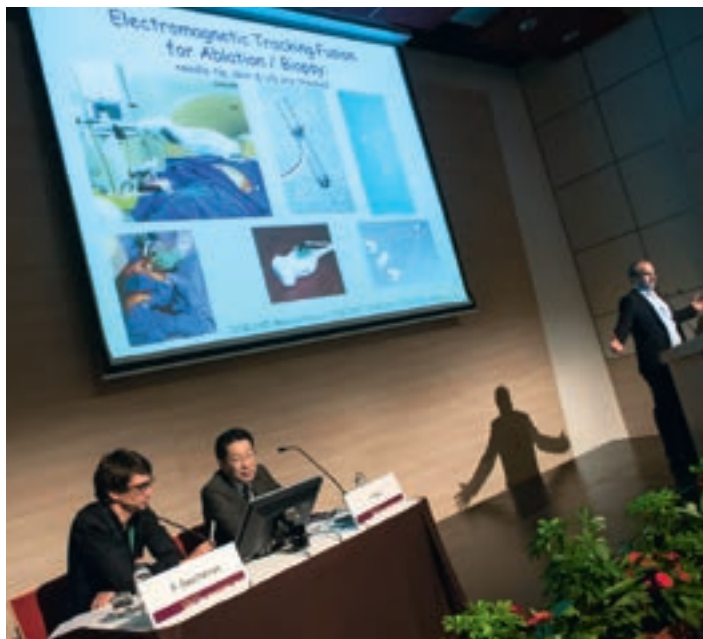
Interventional oncology imaging should support accuracy in interventions and allow a complete treatment of the targeted tissue, with the required safety margins.

Prof. Philippe Pereira (Heilbronn/DE) spoke about how MR guidance fulfils these requirements and has an effective role to play in treatment planning, targeting, intraprocedural monitoring and intraprocedural planning.

The use of MR for guidance in IO can be justified by the fast, exact positioning of the applicator to the treatment area. Also advantageous is the real-time multiplaner control afforded by MR, which enables accurate 3D assessment. This precision means MR is suited for the guidance of treatment of tumours near large vessels and in difficult locations or near sensitive structures.

PET-CT (Positron emission tomography - computed tomography)

There is an increasing need in interventional oncology to be able to accurately target lesions that cannot be seen by many of the standard imaging modalities and Dr. Constantinos Sofocleous (New York, NY/US) spoke about the strengths of PET-CT in this regard.



An exciting development for image-guided tumour interventions, the PET-CT biopsy technique offers interventional radiologists the potential to target biopsies more effectively, aiming at the hypermetabolic area of the tumour which corresponds to higher cellularity.

Furthermore, improved clinical outcomes may be on the horizon if PET-CT can be utilised as a real-time image surrogate biomarker of tumour ablation efficiency.

Robotics and navigation

Dr. Fred Moeslein (Baltimore, MD/US) gave a presentation on how robotics can support an increased ability to navigate to tumours in a reproducible way. The growth of this technology will increase the availability of high-level care to more and more patients around the world, even outside of the small number of existing special centres.

Robotic assistance has been shown to increase operator speed of needle placement, which has implications for decreased radiation exposure to the patient and doctor during IO procedures.

All presentations are available at www.esir.org

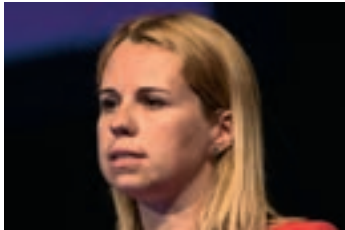
Hepatocellular carcinoma

One area where huge progress has already been made is liver cancer. Even at this early stage, IR's role in treating liver cancer is well recognised, with new approaches and new data continually emerging.

Early-stage HCC

The tumour presentation for which the most IR data exists is small HCC (≤ 3 cm). The efficacy of RFA has been demonstrated, and it is already included in many treatment protocols, but many questions remain about optimal management.

A dedicated session dealt with many of these questions. Dr. Laura Crocetti (Pisa/IT) addressed non-invasive diagnosis, comparing the different modalities available, including dynamic CE-CT, diffusion-weighted MRI, 4-phase MDCT and dynamic CE-MRI. Their advantages and limitations were compared against current diagnostic criteria, concluding that due



to the accuracy of modern radiological imaging, only inconclusive findings should be biopsied.

Dr. Alejandro Forner (Barcelona/ES) of the Barcelona Group examined the current indicators of prognosis. Most guidelines do not take treatment into account in scoring, with only the current BCLC Guidelines doing so. Dr. Forner explained the importance of evaluation beyond the tumour burden and liver function (e.g. locations, other co-morbidities), as well as the value of a treatment migration concept.

The role of surgery in treating small liver lesions was explained by Prof. Vincenzo Mazzaferro (Milan/IT). He too addressed the limitations of current guidelines: there is not a single surgical modality fits all HCC presentations, and individual patient and tumour characteristics must be considered.

Prof. Riccardo Lencioni (Pisa/IT) discussed the role of RFA, which can provide results comparable to liver resection for single HCC ≤ 3 cm occurring in compensated cirrhosis. However, there is a need for options with more complete or predictable results, e.g. MWA or IRE. While RFA is still the standard in ablation techniques, promising novel technologies warrant further investigation.

Finally, a special 'Worldview' discussion examined the question "is ablation replacing resection for small tumours?" from several different perspectives. Prof. Hyunhul Rhim (Seoul/KR) discussed current practice in Asia, concluding that RFA is replacing surgery for single HCC < 2 cm in a good location, but in co-operation rather than competition. Prof. Philippe Pereira (Heilbronn/DE) gave the European perspective, explaining that RFA is equivalent to surgical resection, while being less expensive, easily repeatable and achieving lower complication rates, while stressing that the treatment decision must be multidisciplinary and individualised. Dr. William Rilling (Milwaukee, WI/US) had similar views, stressing that ablation is not replacing surgery, but that patient selection is being refined.

Intermediate-advanced HCC

Ablation is currently not suitable for this stage of liver cancer, but a number of different approaches are under investigation, and early results are promising. The possibilities were discussed at a dedicated Special Session, as well as in the *ECIO meets ILCA* session.



ECIO meets ILCA

Chemoembolisation

The merits of TACE were discussed by Dr. Mike Soulen (Philadelphia/US) and Prof. Jeff Geschwind (Baltimore, MD/US). Dr. Soulen discussed the history of lipiodol chemoembolisation, whose oily properties allow for chemo drugs to be delivered without washing out. While widely recognised to be advantageous, hard data is difficult to acquire, as there is no standard dosage, leading to heterogenous usage. Examining the data, Dr. Soulen concluded that cTACE is probably not a gold standard for treatment, but remains a good standard.



Countering this, Prof. Geschwind addressed the advantages of DEB-TACE. Use of microspheres allows IRs to maximise drug delivery consistently, achieving long-lasting, sustained delivery without systemic effects. A variety of beads are available, but this presentation was confined to DEB-DOX. After describing the optimal delivery and imaging, Prof. Geschwind discussed the Johns Hopkins and Barcelona Group findings. Both groups confirmed that very little chemo escapes to the system, and showed a response rate of 75%. Level 2-3 evidence is building up, showing that microspheres allow a consistent and repeatable extension of cTACE.

Radioembolisation

The efficacy of and indications for yttrium-90 radioembolisation (RE) were examined by both Dr. Riad Salem (Chicago, IL/US) and Prof. Bruno Sangro (Pamplona/ES).

Dr. Salem explained the rationale of RE. Using yttrium-90 loaded microspheres, it has no macroembolic effects and few side effects. Its use in PVT is tolerated, with better results obtained for branch PVT, with 17-month survival demonstrated. Liver volumes change after RE, closely resembling a surgical resection. There is no randomised Level I evidence yet, but multiple centres (including Mayo Clinic and Cleveland Clinic) have shown the toxicity of Y-90 to be less than that of cTACE. The literature currently shows a very high necrosis rate for BCLC (A), and the same survival rate as TACE with better quality of life for BCLC (B).

Prof. Sangro, a hepatologist, considered how to place RE within the treatment protocol for HCC. To him, the gap between the intermediate and advanced stages within the BCLC classification (between recommendations for TACE and sorafenib) seems a promising niche for Y-90 treatment. Currently, there are a number of patients in the intermediate category who are not candidates for TACE (≥ 7 cm, Stage B patients, etc.). Similarly, for advanced-stage patients, Sorafenib is the standard of care. However, the sub-group with portal vein invasion or vascular invasion are statistically significant, and RE may be a suitable option for down-staging these tumours. As such, RE may have a valuable role to play in future treatment protocols, and should already be considered for such 'in-between' patients.

Molecular and combined therapies

A number of speakers addressed the uses of sorafenib, and how it can be optimised in combination with other therapies. Sorafenib is an inhibitor of STK and RTK, and is strongly indicated for advanced HCC (SHARP Trial).

Prof. Josep Llovet (Barcelona/ES; President of ILCA) discussed the relevance of molecular therapies, as well as many of the trials conducted in their use (e.g. Sunitinib, Brivanib – the BRISK Trial, Crizotinib, Tivantinib, Refametinib in Ras+ HCC patients). Some cancers are caused by a singular molecular aberration, and may display oncogene addiction. Accordingly, genome sequencing in HCC is opening many new therapy options,

presenting signalling pathways as viable targets for treatment and allowing for personalised medicine.

Hepatologist Dr. Peter Galle (Mainz/DE) examined the rationale for combining TACE and sorafenib, and the current landscape of clinical trials. Both therapies play a clear role in therapeutic guidelines, but combining them may enhance efficacy. TACE treats the tumour only, and the peripheral tumour often survives, leading to hypoxic progression. However, combining the two is not straight-forward: sorafenib leads to decreased vascularity, and can interfere with TACE penetration, so different modes of administration may be employed, e.g. sequential (adjuvant), interrupted (to avoid bleeding) or continuous.

Trials are difficult to construct and compare, due to variations in TACE, but the available data nevertheless gives some interesting indications, especially regarding the impact of delivery method and median treatment time. After giving an overview of the major trials of relevance (SOCRATES, COTSUN, START, SPACE), Dr. Galle concluded that the therapies are safe to combine, preliminary efficacy data is promising, but toxicity should be borne in mind, and there is a need for harmonisation of trial designs for the future.

Prof. Riccardo Lencioni (Pisa/IT) also discussed several trials in detail. Although HEAT (a Phase III randomised controlled study of RFA + ThermoDox vs. RFA alone for HCC) failed to meet its primary endpoints, a post-hoc analysis raises some interesting possibilities regarding the effect of RFA duration on treatment efficacy (please see page 6 for more details).

Worldview – Is cTACE being replaced by novel techniques?

Another 'Worldview' discussion on HCC was held at the end of the *Intermediate-advanced HCC* session. Discussing the use of conventional TACE in Asia was Dr. Yasuaki Arai (Tokyo/JP), who believes that it is too early to decide standard treatment (due to varied data and criteria), and cTACE has much advanced, as demonstrated by a Japanese/Korean prospective study, and so Asian IRs see no reason to replace cTACE.

The European perspective was given by Prof. Thomas Helmberger (Munich/DE). He explained that cTACE is clearly effective, although the almost 30 guidelines on HCC worldwide show no agreement on TACE components or regime. Although cTACE is widely used in Europe, the lack of RCT evidence means its specific role is not yet defined, and non-conventional TACE may be more easily assessed.



Dr. Raj Narayanan (Miami/US) presented the North American perspective, where the main competitors are DEB-TACE or radioembolisation: an AJR 2012 survey showed variability in chemoembolisation practice, and a trend toward beads and Y-90, with Y-90 favoured for PVT.

Honorary Lecture

The 2013 Honorary Lecture, *Diagnosis and treatment of HCC: from guidelines to clinical practice*, was delivered by Prof. Carlo Bartolozzi (Pisa/IT), in recognition of his extraordinary teaching achievements and high standards of liver cancer research.

Italy has a high rate of liver disease, and Prof. Bartolozzi's hospital is devoted to management of liver patients, with a strong multidisciplinary approach. In the last 15 years, Italy has seen a dramatic increase of HCC not related to infection. Currently, the majority of non-viral HCC are not being discovered during surveillance, and there is a need to improve guidelines.

Discussing diagnostic algorithms, Prof. Bartolozzi explained the need to think beyond wash-in wash-out to increase sensitivity of diagnosis. He explained the importance of the BCLC system, and questioned whether better biomarkers are needed for follow-up.

The lecture was concluded with a quote from the Barcelona Group's Alejandro Forner: "Recommendations and guidelines serve to frame the situation, but ultimately, the decision to be made will never be automatic, but rather the result of a personalised evaluation that takes into account the scientific evidence and the specific profile of the patient."



Presentations are available at www.esir.org

Colorectal liver metastases

Interventional oncology is actively involved in improving the treatment of colorectal liver metastases (CLM). Of the more than one million new colorectal cancer patients each year worldwide, around 15% have liver metastases at diagnosis and around 60% develop these during follow-up.

Systemic and intra-arterial therapies

After summarising trial results of neoadjuvant, conversion and adjuvant chemotherapy, Dr. Nancy Kemeny (New York, NY/US) explained the rationale behind the use of hepatic arterial infusion in treating CLM and how this affects outcomes at later resection.

Hepatic arterial infusion plus systemic chemotherapy produces high resection rates in patients with initially unresectable disease and, as a



second-line therapy, hepatic arterial infusion with systemic therapy produces higher response and survival rates than those obtained with systemic therapy alone. If this promising foundation is to be built on there is, however, a need for further randomised studies to be conducted.

Ablation

Prof. Vlastimil Válek (Brno/CZ) questioned the paradigm that radio-frequency ablation without surgery is limited to use as a non-curative treatment option reserved for non-surgical candidates.

Evidence was shown that RFA can be applied to metastases of less than 3 cm with curative intent and that in the absence of extensive intra-hepatic or extrahepatic disease, renewed treatment of local recurrences should be considered and is often successful.

Taking into account the available data, RFA and surgical resection should not be considered as mutually exclusive treatment options, but rather as adjunctive strategies.

Drug-eluting beads

As combination therapy has shown benefits over monotherapy, a current challenge in treating CLM is to enhance response rates while minimising overall toxicity to the liver, so as not to preclude resectability.



Prof. Robert Martin (Louisville, KY/US) summarised a range of the latest trial results, showing the use of drug-eluting technology in the multi-modal treatment of CLM.

Focussing on irinotecan-eluting beads, established data show there is a role for drug-eluting technology in curative, adjunctive and palliative treatment phases in combination with systemic chemotherapy. The challenges of variable technique and tolerance are being met, with technique optimisation and agreed algorithms being reported in the literature. Promising reported safety and response rates now need further validation through larger studies.

Radioembolisation

Dr. William Rilling (Milwaukee, WI/US) provided an update on the latest clinical trial results relating to the status of Y-90 radioembolisation. Cost-effectiveness was also taken into account considering the comparative cost of other oncological modalities.

Despite little change in the level of available evidence, there has recently been further demonstration of efficacy and safety in salvage patients. However, if radioembolisation is to continue to compare well against other treatment modalities, Level I evidence is needed.

Evidence of safety is growing for the concurrent use of radioembolisation and chemotherapy and important studies, both recently concluded

and ongoing, will help further define the technique's role in first and second line therapy.

Combination strategies

Many combination strategies exist for treating advanced CLM including chemotherapy, resection and IO techniques. Dr. David Madoff (New York, NY/US) emphasised the importance of using these therapies in tandem, rather than the common clinical scenario where two or more treatments are used together in an unplanned way.

It has been shown that tumour resectability can be notably increased with these strategies. This has a corresponding impact on survival rates but there is still scope for more work to be done if further improvements in overall survival are to be achieved.

Multimodality management

Concluding the session, Prof. Thomas Vogl (Frankfurt/DE) summarised the European perspective on multimodality management of CLM, including clinical results of the various treatment options and their combinations.

Multidisciplinary tumour boards are central to providing the best for patients according agreed to therapeutic strategy pathways. Interventional oncology has a special role in increasing survival time and quality of life for patients with liver metastases that are unlikely to ever become resectable.

Lung cancer

An area of growing interest is minimally invasive treatment options for lung cancer. Although not widely used, there are some indications of the role thermal ablation can play, and experts from surgical, radiotherapy and IR backgrounds discussed the aetiology of the disease and how best treatment can be approached.

Optimised management: surgery and ablation

Prof. Łoic Lang-Lazdunski, a surgeon from Guy's & St. Thomas' Hospital (London/UK) gave a thorough overview of primary lung cancers and how best to select treatment. While surgery is the treatment of choice, only 25% will be suitable for surgical resection with curative intent. Factors in determining eligibility include lung function, co-morbidities and performance status rather than age.

Video-assisted thoracoscopic surgery (VATS) lobectomy is preferred for Stage I & II peripherally located primary lung cancer (<5 cm and no involvement of pulmonary artery or main bronchi), achieving shorter stays, fewer costs, less pain and similar complications compared with open lobectomy. Prof. Lang-Lazdunski gave an excellent overview of the procedure and its outcomes. He also discussed the advantages and applications of VATS segmentectomy and VATS wedge resection.

For patients who are not fit for surgery, however, RFA can be a valuable alternative for single or multiple tumours <3 cm which are located

peripherally. RFA achieves better outcomes than standard radiotherapy, and achieves similar survival rates to SABR in the short and medium term. More comparative data would be useful, particularly comparing RFA and SABR with palliative treatments.

RT: the standard of care for inoperable lung cancer?

The role of radiotherapy in treating pulmonary cancers was discussed by Dr. Lizbeth Kenny (Brisbane/AU). She explained the dismal prognosis associated with lung cancer, which normally presents at an advanced stage, confined to cancers that are operable, but patients who aren't. Dr. Kenny presented evidence to show that radiation treatment is quick, cheap, and achieves good palliation. This is particularly true of stereotactic ablative radiotherapy (SABR), which is superior to standard fractionation and entails high dose, risk-adapted RT schedules. A Dutch study of SABR in 676 NSCLC Stage I and II patients achieved disease recurrence of only 18%, with only a third of these recurrences local. The results have implications for follow-up and potential salvage. Other studies place survival at 3 years at 80-83%, and Dr. Kenny detailed the low morbidity and mortality rates associated with SABR.

Radiotherapy is most probably the standard of care for medically inoperable lung cancers, but largely depends on the capacity of team to consider other options, as well as access to local expertise and ability to deliver high quality precision radiation treatment.



Ablation of primary NSCLC

Prof. Robert Suh of UCLA (Los Angeles/US) examined the various ablation strategies that can be used for Stage I primary lung cancers. Compiling various data sets, Prof. Suh demonstrated that size is the main determinant for prognosis (≤ 3 cm favourable), along with clinical staging.

Other considerations when selecting treatment include gender, tumour location and previous radiation therapy. Data on modalities other than RFA is scarce, with mixed results obtained for MWA. Ablation has also been investigated as an adjuvant to radiotherapy, and cryoablation has been tried in combination with molecular targeted therapy.

A glance at thermal ablation literature shows heterogeneous reporting, with varying tumour size and clinical staging influencing both local control and survival. It is important to note that surgical patients tend to enjoy overall better health, and thus patient cohorts and outcomes can be difficult to compare meaningfully. Nonetheless, technical advances and combination therapies are leading to improved local control, and as this improves, gains in survival will be limited for Stage I NSCLC. It is thus feasible that ablation will eventually reach the gold standard of surgical resection.

Ablation for CRC pulmonary metastases

Shifting the discussion to pulmonary metastases, Dr. Constantinos Sofocleous from MSKCC (New York/US) explained that IR should aim for resection with

clear margins. This can be achieved using a thermocouple, and can be done in a parenchymal-sparing way. Ablation entails fewer complications than surgery, is faster, can be repeated, and does not rule out other therapies. Efficacy was ascertained at MSKCC via post-ablation biopsies (mitochondrial fluorescent stain) as well as surrogate image biomarkers in PET-CT.

Patients treated were either poor candidates for surgery, or experiencing post-surgical recurrence. The best candidates had solitary or a limited numbers of lesions, surrounded by aerated lung. Good patient selection and good technique are important, and imaging follow-up is mandatory – any progression can be retreated. MSKCC found no deterioration of pulmonary function after thermal ablation, which is supported by the literature. The MSKCC RFA data found that size was important for recurrence risk (< 1.5 cm better, > 1.5 cm seven times more likely, with 3-year survival 78% vs. 27%). Technological evolution and translational research will continue to expand the applications of pulmonary ablation.

Other events

ECIO provided additional pulmonary cancer content via two e-voting *Management of complications sessions* – presented by Robert Suh and Gianpaulo Carrafiello (Varese/IT) – and a Multidisciplinary Tumour Board focussing on lung and kidney cancers.

Presentations are available at www.esir.org

Professional issues in IO

Being a clinician is about more than theoretical knowledge and technical expertise. It requires complete patient care, from admission and examination right through to follow-up care, as well as rigorous training and assessment of competence.

This important topic was a common thread throughout the congress, but was explored in greater depth at a joint *ECIO meets ESTRO* session.



ESTRO (the European Society for Radiotherapy and Oncology) shares many common issues with CIRSE, and the two groups put forward their ideas and goals in relation to improving care standards.

The IR as a clinician

The interventional radiologist's perspective was given by Prof. Afshin Gangi (Strasbourg/FR), who was keen to stress the benefits of multidisciplinary co-operation. This has been shown to offer prolonged survival, optional patient comfort, optimal function and superior pain relief.

He also stressed the importance of treating each patient as an individual, and advocated meeting prospective patients face-to-face in consultancy offices and taking time to analyse their real need. The patient should be given a contact name and phone number upon their first consultation, and the benefits and downsides should be explained clearly. The procedure and necessary equipment should be thoroughly planned in collaboration with the nursing staff (and others).

IRs should also ensure their participation in tumour boards, no matter what. This is a key way to gain recognition, and of ensuring your involvement with suitable patients. Familiarity with other therapies is also necessary.

IR is an exciting field – but it is important to make time for the administrative work too.



The RO as a clinician

ESTRO President Prof. Vincenzo Valentini (Rome/IT), introduced the society's *Vision 2020* project, which aims to ensure every cancer patient in Europe will have access to state-of-the-art radiation therapy, as part of a multi-disciplinary approach, where treatments are individualised, taking into account the patient's personal circumstances.

Individual treatment plans are important not only to respect patient choice and ensure that they are offered the best therapy possible, but also as a preparation for new challenges. Soon, ESTRO will be launching the EPAAC Work Package 7, which contains a clinical statement on what radiation oncologists should be aiming for. It will also advocate a multidisciplinary approach, which is recognised to save both lives and clinical costs.

Prof. Valentini finished by advocating a knowledge-based approach to oncology, where clinical decisions are adaptive (based on monitoring and outcomes), use modelling, and result in individual treatment plans, based on prognostic factors.

Training in Oncology – the role of professional societies

This topic was also addressed by representatives of the two societies. Prof. Philippe Pereira (Heilbronn/DE) represented CIRSE, explaining the society's efforts guide adequate training protocols.

As well as establishing interventional oncology as a key sub-discipline within our educational meetings, CIRSE has recently published a dedicated Syllabus and Curriculum, containing dedicated oncology chapters. This outlines general competencies, such as clinical practice, patient safety and team work, and has been endorsed by 26 national IR societies. Additionally, the recently introduced EBIR exam offers the first Europe-wide IR qualification, with interventional oncology forming a substantial part of the exam.

Furthermore, the European School of Interventional Radiology offers many educational platforms, from the online database (containing special interventional oncology packages) to local training courses. Moreover, ESIR also offers educational grants, allowing trainees to spend time at specialist institutes abroad. Finally, CIRSE's new Oncology Alliance Subcommittee will work to build links with other oncology interest groups and further the exchange of knowledge.

The Radiation Oncology perspective

ESTRO has long history of training, ranging from its Core Curriculum (which is UEMS-endorsed) and annual teaching course to online education. Importantly, it is also an inter-professional society, and caters for nurses, RTs, radiation biologists, and physicists, as well as radiation oncologists.

ESTRO also co-operates with many societies, in order to ensure optimal treatment of patients. It holds 35 courses per annum (in Europe and further afield), both large and small, including multidisciplinary courses, technical courses, biology and image-based courses. These courses have a limited faculty, to facilitate human relationships. They attract approximately 3,000 participants per annum, with roughly a third coming from outside Europe. Mobility grants are also provided, as are virtual courses (EAGLE, FALCON and DOVE).

Radiation oncology faces many of the same challenges as interventional oncology, and this natural partnership should be pursued to ensure optimal patient care.

Collaboration

Dr. Lizbeth Kenny (Brisbane/AU) also outlined the many benefits of multidisciplinary collaboration, which are beneficial for both patients and doctors, providing a safe-haven for being brave.

Dr. Kenny also pointed out that while research is hugely important, Phase III RCTs are becoming less applicable to oncology and its rapidly changing technology, and a more flexible approach is needed. Currently, there is robust evidence for radiation oncology, but for interventional oncology, there is less evidence available.



As a member of a local divestment board, Dr. Kenny is acutely aware of the need for both sensible investment and evidence to facilitate this. Currently, 80% of research money is spent on pharmaceuticals, although this area has the least impact. Local cures (surgery, IO, radiation oncology) get far less investment. Palliation is the most expensive part of care, and one third of health spending is on end-of-life care.

As such, additional evidence is needed to support the use of IR. And this evidence should move from trial-based efficacy to real-world effectiveness, using high quality observational studies based on large databases. There is a need to refocus on patients rather than disease. IO is likely to fare well on QALYs, economic burden and patient satisfaction, and should urgently begin to acquire these data.

ECIO 2013 Sponsors

Our corporate partners play an important role in both the meeting and the sub-specialty – their involvement and expertise are essential in providing the tools needed to treat our patients.

The following companies kindly sponsored many aspects of ECIO 2013, from Workshop materials to Satellite Symposia, as well as taking part in our technical exhibition.

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Their involvement and support is greatly appreciated!

A gateway to interventional oncology – ECIO 2014

The exciting array of scientific information presented at ECIO 2013 reaffirms the decision to hold the meeting annually, and plans for 2014 are already underway.

Next year's congress will be held in Berlin, a fellow hub of dynamism and innovation, in the highly regarded Estrel Convention Center. This modern and multi-functional location offers us a generous variety of lecture halls and rooms, ample space for our technical exhibition, and 1,125 rooms in the adjacent Estrel Hotel.

New features

Several new formats are planned, notably two Video Learning Sessions. These will feature case presentations, introducing more variety still into the range of learning opportunities on offer at ECIO.

Our range of Hands-on Workshops will also be expanded to include radioembolisation – a rapidly growing field of interventional oncology.

Interdisciplinarity

Collaboration with our partner societies will continue, and several joint sessions will be featured in the programme. Not only will our colleagues at ILCA, WCIO and ESTRO join us once more, but the European Organisation for Research and Treatment of Cancer plans to join them!

The successful 'Bring Your Referring Physician' programme will be continued, allowing IRs the opportunity to bring their non-radiologist colleague to the congress free of charge.

Mark your calendar

Congress Chairperson Thierry de Baère and Deputy Chairperson Thomas Helmberger look forward to welcoming you to another memorable European Conference on Interventional Oncology. The Scientific Programme Committee have designed a dynamic and comprehensive programme, featuring some of the world's best-regarded oncology experts. Keep an eye on our website, www.ecio.org, for regular updates.

The countdown has begun – be sure to join us in Berlin for the interventional oncology meeting of the year!



ECIO 2014

Fifth European Conference on Interventional Oncology

April 23-26
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CIRSE



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