

Pioneering IR Prof. Reto Bale talks to us about his clinical work and what to expect from December's tumour ablation course.



High-end technologies high in the Alps: the pinnacle of tumour ablation

E D U C A T I O N

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CIRSE: You are well known as an expert in tumour ablation – can you describe what your current practice looks like?

Bale: My team consists of three interventional radiologists and six radiation technicians. We have a CT with sliding gantry and treat patients simultaneously in two rooms next to each other. One room is dedicated to complex stereotactic interventions and the other room is mainly used for diagnostic scans and standard interventions, including periradicular and facet joint infiltrations, biopsies, drainages, etc. For sophisticated stereotactic interventions we have two 3D navigation systems and one robot available.

Per year, we currently perform approximately 250 complex thermal ablations (SRFA) of primary and secondary liver tumours and approximately 80 thermal ablations of tumours in other organs including lungs, kidneys, bone, lymph node and soft tissue. In addition, we use radiofrequency ablation for the treatment of trigeminal neuralgia and other neuropathic disorders. All of our patients are treated under general anaesthesia.

CIRSE: What guidance are you using and how do you ensure accurate burn zones?

Bale: All thermal ablations are performed under stereotactic guidance with image fusion. The 3D navigation system is used for 3D planning of the ablation zone, precise positioning of the ablation probes and verification of the ablation result. Intra-operative verification of the result by fusion of the contrast-enhanced CT immediately after probe retraction with the planning CT (before

ablation) is key for reliable thermal ablation. If the required ablation margin of at least 0.5 cm is not achieved, the thermal ablation procedure is continued by placement of additional probes in the same session.

CIRSE: Your work in robotics and stereotaxy is clearly not "standard" in an IR setting. Where do you source your equipment from?

Bale: In 1994, I started as a student with 3D navigation in ENT (for videoendoscopic surgery). In 1996 we founded the SIP Lab (Stereotaxy, Intervention and Planning) at the Department of Radiology in Innsbruck (under Director Werner Jaschke). The navigation system was used for stereotactic punctures at our department but we also provided our "navigation service" to other departments including radiotherapy (for stereotactic brachytherapy), neurosurgery (for stereotactic brain tumour surgery and biopsy), craniomaxillofacial surgery (for complex 3D-navigated reconstructive surgery) and orthopaedic and trauma surgery (for 3D-navigated spine fixation, percutaneous pelvic fracture fixation, etc.). Initially the interdisciplinary use of the navigation system justified the investment in this relatively expensive equipment for the hospital administration. In the meantime, most departments have their own navigation systems and their trained teams, and we are now focusing on interventional oncology only. The costs of the infrastructure, equipment and staff are clearly justified by the additional benefit of sophisticated guidance and fusion methods for our patients, as compared to standard US- or CT-guidance.



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CIRSE: A set-up such as this is clearly costly – what are the benefits of investing so much in IR up front?

Bale: In my opinion more than 90% of liver resections may be replaced by minimally invasive stereotactic thermal ablations with at least comparable results but at lower costs. The cost of the SRFA procedure itself is comparable to liver resection. However, it is associated with shorter hospital stay and intensive care stay, shorter patient regeneration time and fewer complications.

If a complete ablation (A0 in analogy to R0, as confirmed by image fusion) can be achieved, thermal ablation should be the first-line treatment, even in resectable patients.

CIRSE: What kind of outcomes do you achieve?

Bale: We performed the first stereotactic radiofrequency ablation (SRFA) in 2001. Since then, our team has successfully treated more than 1,000 patients with 4,000 liver tumours. Every intervention (and every single tumour) is documented in a detailed database, which is directly integrated in the hospital information system. With a few mouse clicks, the actual relevant data including local recurrence, survival and complications can be extracted.

In a recent paper in *Hepatology*, we demonstrated that even large hepatocellular carcinomas can be completely devitalised (A0 in analogy to R0) by thermal ablation only, as confirmed by histopathologic examination. Complete pathological response in explanted liver specimens

after liver transplantation was achieved in 183 of 188 nodules (97.3%) and 91 of 96 patients (94.8%), respectively. In lesions ≥ 3 cm, complete tumour cell death was achieved in 50 of 52 nodules (96.2%). Residual tumour did not correlate with tumour size. Therefore, SRFA challenges resection as first-line treatment not only in small lesions, but also in lesions > 3 cm. Moreover, the combination therapy (thermal ablation and TACE) can be replaced by SRFA only, with excellent results. Due to the application of highly effective thermal ablation, liver transplantation may be replaced or at least postponed in patients with normal liver function.

Long-term data after SRFA of patients with colorectal liver metastases, melanoma liver metastases, breast cancer liver metastases and intrahepatic cholangiocellular carcinoma showed at least comparable survival data as compared to surgical resection.

CIRSE: What are the current trends in tumour ablation – what imaging systems are most routinely used? Are they, in your view, “reliable” enough?

Bale: Most thermal ablation procedures are still performed under conventional ultrasound or CT guidance. However, upcoming results justify the use of more sophisticated (and also more expensive) techniques in order to improve the results of thermal ablation.

Unfortunately, the results after conventional US- and CT-guided thermal ablation in large lesions are still poor. The reason therefore is

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> obvious: it is essential to ablate the lesion including a sufficient safety margin. The short diameter of the ablation zone with one RFA or MWA probe depends on the ablation technology and probe design. Even with the latest generation of MWA probes, only a maximum diameter of 4 cm can be achieved with one probe position. Thus, for most lesions, multiple overlapping ablation zones are required, which is very difficult to achieve with conventional US- and CT-guidance. In my opinion, these techniques are not reliable enough to compete with surgical resection in liver tumours larger than 1–2 cm. For this reason, at least, image fusion for immediate verification of the ablation result should be mandatory.

CIRSE: Will the December course focus on widely-used technologies or also novel devices?

Bale: The course will mostly focus on novel technology and the combination of already widely used technologies and devices. Our faculty will share multiple interesting patient cases, which will stimulate interesting and controversial discussions.

We are planning hands-on training in the latest image fusion, sono-navigation, cone-beam CT guidance and stereotactic CT-guidance techniques.

CIRSE: What are you most looking forward to at December’s course?

Bale: I am looking forward to exciting discussions between our distinguished international faculty and the participants. It’s a key ingredient in sparking new ideas and refining existing practice, and one that should not be underestimated.

CIRSE: Why should IRs travel to Innsbruck for this course?

Bale: IRs will learn the essentials for reliable treatment of tumours. An internationally distinguished faculty will train the participants in sophisticated planning, guidance and image fusion. We are very grateful that the most relevant companies in the field will give the participants the opportunity to gain experience with their latest and most sophisticated devices. I guarantee that everybody, including the faculty and myself, will learn a lot from the theoretical introductions, the case discussions and the hands-on workshops.

Watch Innsbruck Medical University's video about Prof. Bale's work in tumour ablation:



...or read the open-access paper in *Hepatology*:

