

Microwave ablation for treating liver metastases

HealthTech guidance
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Your responsibility

This guidance represents the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, healthcare professionals are expected to take this guidance fully into account, and specifically any special arrangements relating to the introduction of new interventional procedures. The guidance does not override the individual responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or guardian or carer.

All problems (adverse events) related to a medicine or medical device used for treatment or in a procedure should be reported to the Medicines and Healthcare products Regulatory Agency using the Yellow Card Scheme.

Commissioners and/or providers have a responsibility to implement the guidance, in their local context, in light of their duties to have due regard to the need to eliminate unlawful discrimination, advance equality of opportunity, and foster good relations. Nothing in this guidance should be interpreted in a way that would be inconsistent with compliance with those duties. Providers should ensure that governance structures are in place to review, authorise and monitor the introduction of new devices and procedures.

Commissioners and providers have a responsibility to promote an environmentally sustainable health and care system and should assess and reduce the environmental impact of implementing NICE recommendations wherever possible.

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This guidance replaces IPG406 and IPG553.

1 Recommendations

- 1.1 Current evidence on microwave ablation for treating liver metastases raises no major safety concerns and the evidence on efficacy is adequate in terms of tumour ablation. Therefore this procedure may be used provided that standard arrangements are in place for clinical governance, consent and audit.
- 1.2 Patient selection should be carried out by a hepatobiliary cancer multidisciplinary team.
- 1.3 Further research would be useful for guiding selection of patients for this procedure. This should document the site and type of the primary tumour being treated, the intention of treatment (palliative or curative), imaging techniques used to assess the efficacy of the procedure, long-term outcomes and survival.

2 Indications and current treatments

- 2.1 Liver metastases are a common manifestation of many primary cancers. The liver is the main site for metastases originating from colorectal or other gastrointestinal tract cancers.
- 2.2 The number, location and size of the metastases as well as the patient's general health and the site of the primary cancer all influence the choice of treatment for liver metastases. For a minority of patients, surgical resection with curative intent may be possible. While non-surgical ablative techniques may be used with curative intent, for most patients treatment is palliative. Options for palliative treatment include systemic chemotherapy, external beam radiotherapy, thermal ablation techniques (such as radiofrequency or cryotherapy), arterial embolisation techniques, and selective internal radiation therapy. Multiple treatment modalities may be used for individual patients.
- 2.3 Thermal ablation techniques are normally used in patients for whom surgery would not be suitable, or for treating recurrence following surgical resection. They may also be used as an adjunct to hepatic resection, either to downstage the disease to facilitate liver resection or to ablate small-volume disease in the liver remnant after resection.

3 The procedure

- 3.1 Microwave ablation aims to destroy tumour cells using heat, which creates localised areas of tissue necrosis with minimal damage to surrounding normal tissues.
- 3.2 The procedure can be done using local anaesthesia or with the patient under general anaesthesia, either percutaneously or during open or laparoscopic surgery. A probe is advanced into each targeted lesion under imaging guidance and the tumour is ablated by delivering high-frequency microwave energy. Multiple pulses of energy may be delivered during a session, and multiple probes can be used to treat larger tumours.
- 3.3 A variety of different microwave devices can be used for this procedure.

4 Efficacy

This section describes efficacy outcomes from the published literature that the committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [interventional procedure overview](#).

- 4.1 A randomised controlled trial of 30 patients with multiple colorectal liver metastases reported that the 1-year, 2-year and 3-year survival rates were 71%, 57% and 14% respectively in patients treated by microwave ablation (MWA), and 69%, 56% and 23% respectively in patients treated by liver resection. Mean overall survival was 27 months in patients treated by MWA and 25 months in patients treated by liver resection ($p=0.83$); mean disease-free survival was 11 months and 13 months respectively ($p=0.47$). A non-randomised comparative study of 89 patients treated by MWA ($n=35$) or radiofrequency ablation (RFA; $n=54$) reported overall survival rates at follow-up of 1, 2, 3 and 5 years of 82%, 67%, 56% and 44% respectively for MWA and 87%, 55%, 44% and 32% respectively for RFA (no significant difference between groups).
- 4.2 A retrospective comparative study of 81 patients (20 patients treated by MWA with or without local resection, 36 patients treated by liver resection, and 25 patients treated palliatively) reported 4-year survival rates of 41% in the whole MWA group, 70% in the liver resection group and 4% in the palliative treatment group (significant survival benefit reported in patients treated by MWA compared with the palliative treatment group). The same study reported that 50% (10 of 20) of patients treated by MWA were still alive at a median follow-up of 30 months and 25% (5 of 20) were disease-free. A non-randomised controlled study of 53 patients with liver metastases reported overall survival rates at follow-up of 1 year, 3 years and 5 years of 80%, 51% and 17% in patients treated by MWA plus resection and of 87%, 49% and 44% in patients treated by resection alone ($p=0.43$ for the overall comparison). Disease-free survival was 33% at 1-year follow-up and 17% at 3 years in the MWA plus resection group, and 26% at 1 year and 11% at 3 years in the patients treated by resection alone ($p=0.54$ for the overall comparison).
- 4.3 A case series of 450 patients with primary or metastatic liver tumours reported overall survival rates at follow-up of 3 years and 5 years of 45% and 17%

respectively in patients with colorectal liver metastases, of 70% and 54% in patients with neuroendocrine liver metastases, and of 48% and 23% in the patients with other liver metastases. The same study also reported median overall survival of 32 months in patients with colorectal liver metastases, 92 months in patients with neuroendocrine liver metastases and 25 months in patients with other liver metastases.

4.4 A retrospective matched-cohort comparative study of 134 patients treated by MWA (n=67) or RFA (n=67) reported recurrence rates at the site of ablation of 6% in the MWA group at a median follow-up of 18 months and 20% in the RFA group at a median follow-up of 31 months ($p<0.001$). The same study reported ablation-site recurrence rates at 2-year follow-up of 7% for MWA and 18% for RFA ($p=0.01$).

4.5 The non-randomised comparative study of 89 patients reported local recurrence in 9% (3 of 35) of patients in the MWA group and in 20% (11 of 54) of patients in the RFA group at a mean follow-up of 32 months ($p=0.072$). Distant recurrence (defined by the presence of intrahepatic new tumour nodules) was reported in 43% (15 of 35) of patients in the MWA group and in 56% (30 of 54) of patients in the RFA group ($p=0.242$).

4.6 In the non-randomised controlled study of 53 patients, there was no significant difference in hepatic recurrence-free survival between the patients treated by MWA plus resection and the patients treated by resection only; rates were 56% at 1-year follow-up and 39% at 3 years and 5 years in the MWA plus resection group, and 55%, 42% and 35% respectively in the resection-only group ($p=0.86$ for the overall comparison). The matched-cohort comparative study of 19 patients reported local recurrence in 1 patient out of 6 treated by MWA and in none treated by RFA (no further details provided).

4.7 The case series of 450 patients (334 procedures for liver metastases) reported local recurrence in 5% (34 of 680) of completely ablated lesions. The same study reported median recurrence-free survival lengths of 24 months in patients with colorectal liver metastases, 33 months in patients with neuroendocrine liver metastases and 25 months in patients with other liver metastases. Recurrence-free survival rates at 3-year and 5-year follow-up were 34% and 9% respectively in patients with colorectal liver metastases, 36% and 11% in patients

with neuroendocrine liver metastases, and 31% and 9% in patients with other liver metastases.

4.8 The non-randomised comparative study of 89 patients reported complete ablation rates at 1 month after the procedure in 94% (58 of 62) of tumours in the MWA group and in 84% (59 of 70) of tumours in the RFA group ($p=0.094$). A prospective case series of 1,249 patients with primary or metastatic liver tumours (307 with liver metastases) reported local tumour progression rates of 10% at 1-year follow-up, 15% at 2 years and 17% at 3 years; 73% (20 of 27) occurred within 1 year, 24% (6 of 27) between 1 and 2 years and 1 developed after 2 years.

4.9 Specialists advisers listed key efficacy outcomes as overall survival, progression-free survival, rates of local recurrence, control of primary tumour (residual tumour rate defined as absence of any tumour on first post-procedure imaging), and tumour response as assessed by Response Evaluation Criteria in Solid Tumours (RECIST) criteria.

5 Safety

This section describes safety outcomes from the published literature that the committee considered as part of the evidence about this procedure. For more detailed information on the evidence, see the [interventional procedure overview](#).

- 5.1 There were no procedure-related deaths following microwave ablation (MWA) reported in a randomised controlled trial (RCT) of 30 patients or in 4 comparative studies of 89, 81, 53 and 19 patients.
- 5.2 Peritoneal haemorrhage was reported in 1 patient in a case series of 736 patients (187 with metastases) treated by MWA; the patient was treated by blood transfusion (no further details provided).
- 5.3 Haemobilia was reported in 1 patient out of 6 treated by MWA in the matched-cohort comparative study of 19 patients treated by MWA or radiofrequency ablation (RFA); this was managed conservatively (no further details provided).
- 5.4 Hepatic abscess was reported in 1 patient out of 14 treated by MWA in the RCT of 30 patients treated by MWA or RFA; this was treated by antibiotics (no further details provided). Multiple liver abscesses were reported in 1 patient out of 20 treated by MWA in the retrospective comparative study of 81 patients; the abscesses were drained percutaneously and treated by antibiotics. Liver abscess was reported in 2 patients with liver metastases in a case series of 1,136 patients (257 with metastases) treated by MWA; these were treated by aspiration or drainage (no further details provided). Hepatic abscess was reported in 1 patient in the case series of 736 patients (187 with metastases): this was treated by drainage (no further details provided).
- 5.5 Bile duct fistula was reported in 1 patient out of 14 treated by MWA in the RCT of 30 patients; this was treated by antibiotics (no further details provided). Biliary fistula was reported in 1 patient out of 37 treated by MWA plus resection, and in 1 patient out of 16 treated by resection alone in the non-randomised controlled study of 53 patients (measurement of significance and length of follow-up not reported).

5.6 Biloma was reported in 1 patient with liver metastases in the case series of 1,136 patients (257 with metastases); this was treated by drainage (no further details provided).

5.7 Jaundice caused by biliary stenosis was reported in 1 patient in the case series of 736 patients (187 with metastases); this was repaired surgically (no further details provided). Hyperbilirubinemia was reported in 1 patient out of 37 treated by MWA plus resection in the non-randomised controlled study of 53 patients (no further details reported).

5.8 Asymptomatic left portal vein thrombosis with segmental liver infarction was reported in 1 patient in a case series of 26 patients with colorectal liver metastases treated by MWA (no further details provided).

5.9 Respiratory problems were reported in 15% (3 of 20) of patients treated by MWA in the retrospective comparative study of 81 patients; they were treated by non-invasive ventilation support and were reported to be mainly associated with complications from the colorectal surgery (no further details reported). Transient deterioration of pulmonary function was reported in 1 patient who was asthmatic and who had a simultaneous lung ablation in the case series of 26 patients (no further details reported).

5.10 Pneumothorax was reported in 1 patient in the case series of 736 patients (187 with metastases); this was treated by drainage (no further details provided). Pneumothorax was reported in 8% (2 of 26) of patients in the case series of 26 patients; this was treated by thoracostomy.

5.11 Pleural effusion was reported in 1 patient out of 20 treated by MWA in the retrospective comparative study of 81 patients; it was treated by percutaneous drainage. Pleural effusion was reported in 2% (4 of 257) of patients with liver metastases in the case series of 1,136 patients (257 with metastases); this was treated by aspiration or drainage (no further details provided).

5.12 Haemothorax with intrahepatic haematoma was reported in 1 patient in the case series of 736 patients (187 with metastases); this was treated by drainage (no further details provided).

5.13 Skin burn was reported in 1 patient with liver metastases in the case series of 1,136 patients (257 with metastases); this was treated by full-thickness resection and suture (no further details provided).

5.14 Infection was reported in 1 patient out of 37 treated by MWA plus resection in the non-randomised controlled study of 53 patients (no further details reported).

5.15 Intestinal obstruction was reported in 8% (3 of 37) of patients treated by MWA plus resection in the non-randomised controlled study of 53 patients (no further details reported).

5.16 Tumour seeding was reported in 1 patient in the case series of 736 patients (187 with metastases); this was treated surgically (no further details provided).

5.17 In addition to safety outcomes reported in the literature, specialist advisers are asked about anecdotal adverse events (events which they have heard about) and about theoretical adverse events (events which they think might possibly occur, even if they have never done so). For this procedure, specialist advisers reported diaphragmatic injury as an anecdotal adverse event. They considered that the following were theoretical adverse events: damage to adjacent structures (including lung, diaphragm, bowel, or gallbladder), vascular injury, ascites, impaired liver function, fever and pain.

6 Committee comments

6.1 The committee noted the patient commentary received and that the procedure is well-tolerated.

Update information

Minor changes after publication

January 2026: Interventional procedures guidance 553 has been migrated to HealthTech guidance 409. The recommendations and accompanying content remain unchanged.

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Endorsing organisation

This guidance has been endorsed by Healthcare Improvement Scotland.