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AN INITIATIVE OF THE NATIONAL, STATE AND
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AND THE GOVERNMENT OF NEW ZEALAND

Horizon Scanning Technology Prioritising Summary

Microwave ablation for hepatic tumours

August 2008



**Australian
Safety
and Efficacy
Register
of New
Interventional
Procedures -
Surgical**



**Royal Australasian
College of Surgeons**

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PRIORITISING SUMMARY

REGISTER ID S000084

NAME OF TECHNOLOGY MICROWAVE ABLATION FOR THE TREATMENT OF HEPATIC TUMOURS.

PURPOSE AND TARGET GROUP PATIENTS WITH UNRESECTABLE HEPATIC TUMOURS.

STAGE OF DEVELOPMENT (IN AUSTRALIA)

- | | |
|--|---|
| <input type="checkbox"/> Yet to emerge | <input type="checkbox"/> Established |
| <input checked="" type="checkbox"/> Experimental | <input type="checkbox"/> Established <i>but</i> changed indication or modification of technique |
| <input type="checkbox"/> Investigational | <input type="checkbox"/> Should be taken out of use |
| <input type="checkbox"/> Nearly established | |

AUSTRALIAN THERAPEUTIC GOODS ADMINISTRATION APPROVAL

- | | | |
|---|-------------|---------------|
| <input checked="" type="checkbox"/> Yes | ARTG number | 129880 |
| <input type="checkbox"/> No | | |
| <input type="checkbox"/> Not applicable | | |

INTERNATIONAL UTILISATION

COUNTRY	LEVEL OF USE		
	Trials Underway or Completed	Limited Use	Widely Diffused
Australia	✓		
China	✓		
Japan			✓
UK	✓		
USA	✓		

IMPACT SUMMARY

Microwave ablation is a potential alternative to radiofrequency ablation in patients with hepatic tumours who are not candidates for surgical resection. This technology is currently in the experimental stage in Australia.

BACKGROUND

Hepatocellular carcinoma (HCC) describes the abnormal and uncontrolled proliferation of cells in the liver, more commonly known as liver cancer. Although the gold standard for the treatment of liver cancer is surgical resection, there are a significant proportion of hepatic tumours where this is not possible (Bertram et al. 2006). Up to 33% of patients with HCC are ineligible for surgery due to the already advanced stage of their tumour or underlying liver cirrhosis (Xu et al. 2004; Iannitti et al. 2007). Liver transplantation, which is appropriate in patients with concurrent liver failure, results in significantly lower rates of HCC recurrence compared with resection. However, the increased mortality and long wait time associated with liver transplantation means very few patients benefit from this treatment (Xu et al. 2004).

For patients with HCC that cannot be treated with surgery or chemotherapy due to advanced liver dysfunction, or those who have undergone these treatments to no avail, there are minimally invasive options, which can be classified into two treatment groups (Dodd et al. 2000; Xu et al. 2004):

1. Chemical ablation

- Ethanol injection: This is the most common chemical method for treating primary malignant liver tumours. Percutaneous injection of ethanol into tumour cells, under local anaesthetic, causes dehydration of the cytoplasm, coagulation necrosis and fibrous reaction. Injection into tumour vessels causes necrosis of endothelial cells and platelet aggregation, resulting in clotting (thrombosis) and tissue ischaemia (Dodd et al. 2000).
- Acetic acid injection: Performed percutaneously, under local anaesthetic, the capacity of 50% acetic acid to cause coagulative necrosis is approximately three times greater than that of 100% ethanol. Acetic acid has a strong ability to penetrate cells, dissolve lipids and extract collagen (Liang et al. 2000).

2. Temperature-based catheter ablation

- Radiofrequency ablation (RFA): Alternating electric currents in the radiofrequency range are applied via an electrode to living tissue. This causes ionic agitation within the tissue and the resulting friction produces temperatures in excess of 50°C, which cause coagulative necrosis of the tumour. This procedure can be carried out percutaneously or intraoperatively, under local or general anaesthetic, respectively (Dodd et al. 2000; Head et al. 2004).
- Cryoablation: This method uses extremely low temperatures (-20 to -30°C) to irreversibly destroy abnormal cells. Delivered through a cryoprobe, the freezing of cells denatures cellular proteins and causes cell membrane rupture, cell dehydration and ischaemic hypoxia. Cryotherapy is traditionally performed in open or laparoscopic surgery under general anaesthetic, a thinner cryoprobe allows for percutaneous delivery under local sedation (Adam 2002).

Of the minimally invasive treatments for HCC, RFA is the most widely used technique (Iannitti et al. 2007). However, the disadvantages of RFA include its lengthy treatment time and variability in recurrence rates, particularly for larger lesions where recurrence rates can range from 2% to 39% (Iannitti et al. 2007; Martin et al. 2007).

An alternative ablative technique is microwave ablation (MWA), which has a similar mechanism to RFA, but uses energy from a different part of the electromagnetic spectrum (Iannitti et al. 2007). MWA uses electromagnetic energy to agitate adjacent water molecules, creating thermal friction and coagulative necrosis in the target tissue (Iannitti et al. 2007). Like RFA, MWA can be performed percutaneously, under local sedation, with ultrasound guidance (Dodd et al. 2000). Proponents of MWA claim that it offers the ability to perform multiple ablations simultaneously, as well as consistently higher intra-tumoural temperatures, larger tumour ablation volumes, faster ablation times, improved convection profile, and less procedural pain compared with RFA (Martin et al. 2007).

CLINICAL NEED AND BURDEN OF DISEASE

Liver cancer is one of the most common cancers worldwide, with approximately 1.2 million people diagnosed with the disease each year (Cancer Council 2008). In Australia alone, more than 800 new cases of liver cancer are reported annually (Cancer Council 2008).

In Australia, less than 10% of all cases of liver cancer occur in otherwise healthy individuals. The majority of liver cancers are catalysed by cirrhosis, which equates to 80% of liver cancer patients having concurrent liver cirrhosis (The Liver Centre 2008). Causes of cirrhosis include hepatitis B, hepatitis C, alcoholic liver disease, aflatoxin (a metabolic product of a mould contaminant of nuts, grains and beans) and haemochromatosis (a genetic condition leading to excessive iron accumulation in the body) (Fattovich et al. 2004). Hepatitis B and C are the first and second leading causes of liver cancer worldwide, respectively (Fattovich et al. 2004).

The number of deaths caused by cirrhosis and other diseases of the liver was 1,320 in 1997, 1,196 in 2001 and 1,400 in 2006 (Australian Bureau of Statistics 2008a). A high proportion of these deaths were in men (69%) (Australian Bureau of Statistics 2008a). The standardised death rate for malignant tumours of the liver and intra-hepatic bile ducts increased from 3 deaths per 100,000 in 1994 to 4 deaths per 100,000 in 2004 (Australian Bureau of Statistics 2008b). In men, this increase was from 5 to 6 deaths per 100,000 over the same time period and in women from 2 to 3 deaths per 100,000 (Australian Bureau of Statistics 2008b).

DIFFUSION

In 1986 a Japanese team developed a small-diameter coaxial microwave system that could be used to percutaneously ablate deep liver tissue (Dodd et al. 2000). In the early 1990s, MWA was applied to the treatment of liver tumours; however it was not widely adopted because it was only capable of small ablation diameters due to its single 2.4 GHz needle antenna (Iannitti et al. 2007). This issue was resolved with the introduction of

multiple, clustered antennae, which allowed the ablation of larger tumours (Iannitti et al. 2007).

There is one listing for a microwave surgical ablation device on the Australian Register of Therapeutic Goods (ARTG 2008). The registered product name is Guidant Flex 10® Microwave Surgical Ablation Device (ARTG number 129880; product ID number 214632), sponsored by Guidant Australia Pty Ltd (ARTG 2008).

Trials of MWA are currently being conducted in the United States, United Kingdom and China. Australia appears to be in the experimental stage with this technology. Australian trials for MWA of other tissues, such as myocardial and endometrial tissue, are currently being conducted; however, little literature was available regarding its status in the treatment of hepatic tumours.

COMPARATORS

The main comparator of MWA is radiofrequency ablation, as it is the most commonly used ablative technique (Iannitti et al. 2007).

SAFETY AND EFFECTIVENESS ISSUES

Three publications were retrieved for inclusion in this summary. One randomised controlled trial (RCT) (Shibata et al. 2002) and one nonrandomised comparative study (Lu et al. 2005) comparing the safety and effectiveness of MWA and RFA, and one case series study reporting the outcomes of MWA alone (Iannitti et al. 2007).

Shibata et al. (2002) recruited 72 consecutive patients with either a solitary HCC nodule < 4 cm in diameter or 2 to 3 HCC nodules < 3 cm in diameter to be randomly allocated to receive MWA or RFA. Patients were randomly assigned using sealed envelopes (the method of random number sequence generation was not specified) so that a total of 36 patients (46 nodules) were treated with MWA and a total of 36 patients (48 nodules) were treated with RFA. Of the MWA recipients, 78% (28 patients) had a solitary HCC compared with 69% (25 patients) in the RFA group; 17% (6/36) of MWA patients had two HCCs compared with 28% (10/36) of RFA patients; and 6% (2/36) of MWA patients had three HCCs compared with 3% (1/36) of RFA patients. There was no significant difference between the groups regarding the number or size of nodules per patient. The mean age of the 24 men and 12 women in the MWA group was 62.5 years (range 52 to 74 years) and 63.6 years (44 to 83 years) for the 26 men and 10 women in the RFA group ($P>0.05$). There were also no statistically significant differences between the groups with respect to the proportion of patients with elevated serum α -fetoprotein levels (a biomarker used to detect HCC), Child-Pugh cirrhosis class (a measure of prognosis of chronic liver diseases) or the proportion of patients with positive antibodies against hepatitis B and C surface antigens.

The clinical background of the participating patients was confirmed using ultrasound-guided needle biopsy of the solitary HCC in patients with a single nodule and in the largest of the HCC's in patients with multiple nodules (Shibata et al. 2002). All treatment sessions were completed within one month of the initial treatment. At one-week follow

up, dynamic computed tomography (CT) scans were conducted to determine if tumour necrosis was complete; patients with nodule enhancement were considered incomplete and underwent further MWA or RFA. Patients with complete tumour necrosis had a non-enhancing area \geq the diameter of the original lesion. Therapeutic effect was measured with dynamic CT at one month follow up; at this time no nodule enhancement indicated complete therapeutic effect. The mean duration of follow up was 18 months (range 6 to 27) (Shibata et al. 2002).

In the nonrandomised comparative study by Lu et al. (2005), 102 patients who had previously undergone thermal ablation were retrospectively analysed. The inclusion criteria for these patients were < 5 nodules, < 8 cm diameter of any given nodule, no vascular invasion, no lymph node spread and/or distant metastasis and Child-Pugh class $< C$. Ultrasound-guided needle biopsy was performed on all patients to confirm the histology of their HCC. Forty-nine patients (98 nodules) underwent MWA between August 1997 and March 2000, and 53 patients (72 nodules) underwent RFA between March 2000 and July 2002. The mean age of the 44 men and 5 women in the MWA group was 50.1 ± 13.7 (standard deviation [SD]) years (range 24 to 74 years), and the mean age of the 43 men and 10 women in the RFA group was 54.4 ± 11.7 years (20 to 74 years). The mean diameter of the tumours was 2.5 ± 1.2 cm (0.9 to 7.2 cm) in the MWA group and 2.6 ± 1.2 cm (1.0 to 6.1 cm) in the RFA group. Groups were comparable at baseline regarding sex, age, maximum nodule size, hepatitis B and C background, serum α -fetoprotein levels and mean tumour diameter ($P > 0.05$). There was a significant difference seen between the groups in the number of single to multiple nodules, which was 21/28 in the MWA group and 36/17 in the RFA group ($P < 0.05$). Child-Pugh class ratio (A/B) was also significantly different between the groups, with 22/27 in the MWA group and 47/6 in the RFA group ($P < 0.001$). The follow up period in the MWA group was 25.1 ± 12.7 months (2.0 to 50.6 months) compared with 24.8 ± 14.6 months (2.0 to 51.0 months) ($P > 0.05$).

Therapeutic efficacy was assessed with contrast-enhanced CT scans one month after treatment. Complete ablation was considered to have occurred in patients with uniform hypo-attenuation without contrast enhancement in the ablated area. If this was not the case, further ablative treatment was administered. For the first six months of follow up, colour Doppler ultrasounds were carried out and serum α -fetoprotein levels and liver function were measured monthly (3 to 6 monthly thereafter). CT scans of the liver were conducted when these measurements were abnormal. Local recurrence was considered to have occurred when there was regrowth of the tumour inside or neighbouring the previously treated nodule. Distant recurrence occurred when there was an intra- or extra-hepatic growth non-adjacent to the original tumour. Both types of recurrence were treated with additional ablation, where possible (Lu et al. 2005).

Iannitti et al. (2007) conducted a multi-centre study where 87 patients received MWA to treat unresectable primary or metastatic liver cancer. Primary HCC was apparent in 26.4% (23 patients) of cases, with colorectal, breast and carcinoid metastasis being the most common indications for treatment. A total of 94 ablations on 224 tumours took place either percutaneously (48%), laparoscopically (7%) or through open incision

(45%). Of the 87 patients included, 41 were men and 46 were women, with an average age of 67 years (range 37 to 92 years). Average tumour diameter was 3.6 cm (0.5 to 9.0 cm), with 22 tumours > 4 cm in diameter.

All tumours were localised and measured using intraoperative ultrasound or CT fluoroscopy. Patients were also scanned one month after treatment and every four months thereafter for two years. The mean length of follow up was 19 months (Iannitti et al. 2007).

Safety

In the RCT conducted by Shibata et al. (2002), there were no life threatening adverse events observed as a result of either ablation method. Major complications occurred in 4 patients (11% per patients) in the MWA group in 4 sessions (4% per sessions). In this group major complications included liver abscess in one patient, which was resolved using a percutaneous drainage catheter; cholangitis with intra-hepatic bile duct dilation in another patient, which was resolved using antibiotics; subcutaneous abscess with skin burn in one patient, which was resolved by drainage through a skin incision; and subcapsular haematoma in one patient, which resolved with conservative therapy. Major complications occurred less frequently in the RFA group, in one patient (3% per patient) and one session (2% per session). In this case, the patient developed a segmental hepatic infarction, which caused prolonged abdominal pain for two weeks after treatment and elevated serum aspartate transaminase and alanine transaminase (> 1000 U/L) for three days. The patient eventually recovered with conservative therapy. The difference between the two groups in regards to the occurrence of major complications was not significant by patient or session ($P=0.36$; $P=0.67$, respectively). The majority of patients (number not reported) without major complication had elevated serum liver enzymes one day after treatment, but levels returned to normal by seven days follow up (Shibata et al. 2002).

In the nonrandomised comparative study by Lu et al. (2005), the total rate of major complications was 6.9% (7/102 patients). In the MWA group, two patients had slight discharge from their puncture wound, which cleared up with local treatment, while another two patients had subcapsular haematoma, which spontaneously absorbed within two weeks. In the RFA group, two patients had skin burns and one had a puncture wound infection. Thus, the rate of major complications within each group was 8.2% (4/49 MWA patients) and 5.7% (3/53 RFA patients), respectively ($P=0.71$). There were no deaths related to either ablation technique. However, throughout follow up 49% (24/49 patients) of the MWA group and 69.8% (37/53 patients) of the RFA group died. Causes included tumour progression (MWA n=13; RFA n=23), liver function failure (13; 10), upper gastrointestinal bleeding (4; 3) and unknown causes (1; 1) (Lu et al. 2005).

In the case series study by Iannitti et al. (2007), no treatment-related deaths occurred. Two deaths unrelated to either ablation method occurred several months later, resulting in an overall mortality rate of 2.3%. One of the deaths was due to myocardial infarction and the other a cerebrovascular ischaemic event. Non-life threatening procedure-related complications included, skin burns in three patients; wound breakdown, re-admission for nausea or over-sedation, fluid collections and persistent postoperative ileus in two

patients each; and pain requiring termination of the procedure, subcapsular haematoma and fever/staphylococcal infection in one patient each (Iannitti et al. 2007).

Effectiveness

In the RCT by Shibata et al. (2002), 1 to 5 ablation session/nodule were required by patients in the MWA group, with 110 sessions in total (mean 2.4 sessions, SD 1.0). This was significantly more total treatment sessions compared with the RFA group, which required 55 sessions (mean 1.1, SD 0.46) ($P<0.001$). In the MWA group, 24% (11/46 nodules) underwent a single session, 26% (12/46 nodules) underwent two, 39% (18/46 nodules) underwent three, 9% (4/46 nodules) underwent four and 2% (1/46 nodules) of patients underwent five. In the RFA group, 90% (43/48 nodules) underwent a single session, 6% (3/48 nodules) underwent two and 4% (2/48 nodules) underwent three sessions. Mean operative time was significantly lower in the MWA group (33 minutes/session, SD 11) compared with RFA patients (53 minutes/session, SD 16) ($P<0.001$). Intravenous analgesics were required by 15 patients immediately following 15 treatment sessions in the MWA group and 10 patients immediately following 10 treatment sessions in the RFA group. Three of the 15 MWA patients who required analgesics were unable to complete their treatment because of severe pain and underwent subsequent treatment under general anaesthetic.

Complete therapeutic effect was observed in 89% (41/46 nodules) in the MWA group, compared with 96% (46/48 nodules) in the RFA group ($P=0.26$). Residual lesions or incomplete therapeutic effect was seen in 11% (5/46 nodules) in the MWA group. The residual nodules were between 2.5 and 3.4 cm in diameter, four of which (three > 3 cm in diameter and one with a 2.5 cm diameter) were situated near the right portal vein. In addition, all of the nodules ≤ 2 cm ($n=19$) in the MWA group experienced complete therapeutic effect. In the RFA group, 4% (2/48 nodules) had incomplete therapeutic effect. Of the residual nodules < 2 cm in diameter ($n=23$), all had complete therapeutic effect; the two nodules with incomplete effect were 2.4 to 3.0 cm in diameter and situated near the hepatic vein (Shibata et al. 2002).

Residual foci of untreated disease were seen in 17% (8 nodules) of the MWA group (four of which showed incomplete therapeutic effect) and 8% (four nodules) of the RFA group. Rates of residual foci of untreated disease at one year follow up were 10% in the MWA group and 4% in the RFA group, and 24% and 12%, respectively, at two years' follow up. There was no significant difference between the groups for these rates ($P=0.20$) (Shibata et al. 2002).

In the study by Lu et al. (2005), complete ablation was achieved in 94.9% (93/98 nodules) of the MWA group and 93.1% (67/72 nodules) of the RFA group ($P=0.75$). Although the overall difference was not significant, when broken down by tumour size a significant difference was seen. In the MWA group, tumours ≤ 3 cm in diameter were ablated more readily (98.6%; 73/74 nodules) than tumours > 3 cm (83.3%; 20/24 nodules) ($P=0.01$). The same applies in the RFA group, where tumours ≤ 3 cm in diameter were successfully ablated significantly more (98%; 50/51 nodules) than tumours > 3 cm (81%; 17/21 nodules) ($P=0.02$).

There was no significant difference in the overall rate of local recurrences between the groups ($P=0.12$); however, when broken down by tumour size there was. In the MWA group, local recurrence was significantly more frequent in tumours > 3 cm in diameter (30%; 6/20 nodules) compared with tumours ≤ 3 cm (6.8%; 5/73 nodules) ($P=0.04$). The same was apparent in the RFA group, where 33.3% (7/21 nodules) > 3 cm had local recurrence, compared with 11.8% (6/51 nodules) ≤ 3 cm ($P=0.01$). Overall, distant recurrence occurred at a comparable rate between the groups ($P=0.49$), and the time until distant recurrence from initial treatment was also similar ($P=0.53$) (Lu et al. 2005).

Disease free survival rates at one, two, three and four years in the MWA group were 45.9%, 26.9%, 26.9% and 13.4%, and for the RFA group were 37.2%, 20.7% and 15.5%. Therefore, the mean disease free period in each group was not significantly different at 15.5 months (95% confidence interval [CI], 11.3 to 20.0) for MWA treatment and 16.5 months for RFA (95% CI, 10.1 to 19.2) ($P=0.53$). The cumulative survival rates at one, two, three and four years in the MWA versus RFA groups were as follows, 81.6% versus 71.7%, 61.2% versus 47.2%, 50.5% versus 37.6% and 36.8% versus 24.2%. The mean survival time for patients in the MWA and RFA groups were also not significantly different, at 32.5 months (95% CI, 27.4 to 37.7) and 27.1 months (95% CI, 22.5 to 31.8), respectively ($P=0.12$). Cumulative survival rates in patients with ≤ 3 nodules that were ≤ 3 cm in diameter were also not significantly different between the groups ($P=0.12$) (Lu et al. 2005).

In the study by Iannitti et al. (2007), unexpected residual disease was observed in five patients and expected residual disease occurred in three patients. Local recurrence at the ablation site occurred in 2.7% (6/224) of tumours and regional recurrence at the ablation site occurred in 43% (37/87) of patients. By the end of follow up, at 19 months, 47% (41/87 patients) were alive with no sign of disease, 23% (20/87 patients) were alive with cancer and 30% (26/87 patients) had died from the disease. For HCC ($n=23$) specifically, 61% (14 patients) were alive without disease, 13% (3 patients) were alive with the disease and 26% (6 patients) had died. No statistical analyses were reported (Iannitti et al. 2007).

COST IMPACT

The cost of a procedure is generally influenced by its operative duration, the number of treatments required and its risk of complications. Procedures with a greater risk of complication potentially incur more costs as a result of increased recovery time, resulting in either increased medical costs, loss of income, or both. RFA has longer operative duration but requires fewer treatment sessions than MWA, which makes the overall operative time of RFA and MWA comparable. MWA and RFA also have similar safety profiles, therefore the basis of their expense variation will most likely lay in the cost of the equipment required for each.

Economic analysis data from one publication described the costs of various HCC treatment options in US dollars (Dodd et al. 2000). In 2000, RFA generators ranged from US\$12,000 to US\$30,000 and required needle electrodes valued at US\$50 to US\$1,000

(non-reusable) (Dodd et al. 2000). MWA generators cost approximately US\$45,000, with reusable needles valued at US\$500 (Dodd et al. 2000).

Table 1 lists the current treatment options for HCC which are covered by the Medicare Benefits Schedule (MBS), as well as the number of claims made annually for these procedures over the previous four years.

Table 1 Current HCC treatments listed on Medicare Benefits Schedule (MBS 2008).

Item	Description	Fee	Number of Claims/Calendar Year*
50950	NONRESECTABLE HEPATOCELLULAR CARCINOMA, destruction of, by percutaneous radiofrequency ablation, including any associated imaging services, not being a service associated with a service to which item 30419 or 50952 applies (Anaes.)	Fee: \$737.95	2007: 32 2006: 42 2005: 21 2004: 18
50952	NONRESECTABLE HEPATOCELLULAR CARCINOMA, destruction of, by open or laparoscopic radiofrequency ablation, where a multi-disciplinary team has assessed that percutaneous radiofrequency ablation cannot be performed or is not practical because of one or more of the following clinical circumstances: - percutaneous access cannot be achieved; - vital organs/tissues are at risk of damage from the percutaneous RFA procedure; or - resection of one part of the liver is possible however there is at least one primary liver tumour in a non-resectable region of the liver which is suitable for radiofrequency ablation, including any associated imaging services, not being a service associated with a service to which item 30419 or 50950 applies (Anaes.)	Fee: \$737.95	2007: 7 2006: 9 2005: 2 2004: 0
30419	LIVER TUMOURS, destruction of, by hepatic cryotherapy, not being a service associated with a service to which item 50950 or 50952 applies (Anaes.) (Assist.)	Fee: \$737.95	2007: 38 2006: 44 2005: 30 2004: 42

ETHICAL, CULTURAL OR RELIGIOUS CONSIDERATIONS

No issues were identified from the retrieved material.

OTHER ISSUES

No issues were identified from the retrieved material.

SUMMARY OF FINDINGS

From the retrieved literature MWA appears to have a similar safety profile and therapeutic effectiveness as RFA. MWA is less intense than RFA, therefore required greater treatment sessions to remove a tumour than RFA; however, because the individual operative duration of MWA was shorter the overall operative times of both procedures are still comparable, resulting in neither procedure having a cost advantage in this regard. Both procedures are also less efficient in removing tumours greater than 3 cm in diameter. MWA technology is still being refined and future modifications may increase its efficacy in removing HCC.

The quality of the existing studies is insufficiently high to reach reliable conclusions, for example the nonrandomised comparative study by Lu et al. (2005) compared the outcomes of patients with a better Child-Pugh class and fewer multiple nodules (RFA group) with patients with a worse Child-Pugh class and greater multiple nodules (MWA group), confounding its results greatly. Therefore, further evidence (specifically RCTs) is required to fully evaluate the efficacy of MWA, as well as to identify particular patient or tumour subgroups which may respond better to the treatment than others.

HEALTHPACT ACTION

The evidence currently available does not reveal that MWA is in any way more effective compared to RFA for hepatic tumours. Further studies are required before any conclusions can be made. Due to the lack of evidence to support its purported advantages, MWA for hepatic tumours will be archived.

NUMBER OF STUDIES INCLUDED

Total number of studies	3
Level II evidence	1
Level III-3 evidence	1
Level IV evidence	1

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SOURCES OF FURTHER INFORMATION

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SEARCH CRITERIA TO BE USED

Hepatic tumour/tumor OR Liver tumour/tumor
Hepatic cancer OR Liver cancer
Hepatocellular carcinoma
Microwave ablation
Thermal ablation