

Immediate outcome of microwave ablation for liver tumours in a single cohort of patients in Sri Lanka

C. Appuhamy¹, E. Ganewatte¹, S.P.A.L. Ranaweera², A.S. Dassanayake¹, M.B. Gunathilake¹, S. Tillakaratne¹, H.P. Gunawardena¹, M.A. Niriella¹, R.C. Siriwardana¹

¹Faculty of Medicine, University of Kelaniya, Ragama, Sri Lanka.

²Colombo North Teaching Hospital, Ragama, Sri Lanka.

Keywords

Microwave ablation, liver tumours, hepatocellular carcinoma, residual, recurrence, post ablation syndrome

Abstract

Introduction and Objectives

Microwave ablation (MWA) is an emerging treatment modality for hepatocellular carcinoma (HCC) and other liver tumours. We aimed to assess the immediate success and complications of MWA in a cohort of patients.

Method

Patients were assessed retrospectively, using an interviewer-administered questionnaire and a follow-up CECT/MRI at 6-weeks

Result


55 patients underwent MWA from October 2021-May 2022, at Colombo-North Teaching Hospital, Ragama, Sri Lanka, and selected private hospitals (Durdans Hospital, Colombo, Nawaloka Hospital, Colombo, Lanka Hospital, Colombo).

The median age was 64 (40-82) years, with a male preponderance (n=45, 81.1%). The indication was HCC in 54 (98.1%) and metastatic tumour in one (1.8%). The median tumour size was 28 (10-80) mm. Segment VII was the commonest site to be involved (n=18, 34.6%). The majority (n=40, 72.7%) was a single lesion. No participant underwent the procedure twice. The mean post-procedural hospital stay was 12 hours (95%CI=11.4-12.5, SD=2.0).

In the 6-week follow-up, 2 recurrences (3.6%) and single death (1.8%) with no relation to the procedure, were reported. Another 2 (3.6%) denied the follow-up. Complete ablation was reported in 46 patients (83.7%), comparable to the rates in literature (95-97%), with only 7 patients (12.7%) having residual tumours. No major complications were reported. 9

Correspondence: C. Appuhamy

E-mail: chinthaka05a@gmail.com

 <https://orcid.org/0000-0002-1716-9721>

Received: 16-09-2022 Accepted: 27-11-2022

DOI: <http://doi.org/10.4038/sljs.v40i3.9004>



patients (16.4%) developed 'Post ablation syndrome', not as common as in literature (34%). They presented with abdominal pain (7.3%), vomiting (7.3%), and fever (3.6%).

Conclusion

MWA is a successful and safe treatment option for primary liver tumours in Sri Lanka, with ablation rates comparable to the western world

Introduction

Hepatocellular carcinoma (HCC) accounts for 85% of primary malignant liver tumours [1]. Microwave ablation (MWA) is an effective thermal ablative modality in treating HCC. Of the ablation techniques, MWA is considered superior, considering its safety profile with equal effectiveness [2]. In addition, the microwave ablates a wider area while maintaining a consistent intratumoral temperature during the procedure [2]. It has a reported major complication ranging between 2.6-4.6% [1, 3, 4], mortality of 0-0.4% [2, 5], and minor transient complications of around 7.3% [3].

The incidence of HCC is rising due to the increasing prevalence of non-alcoholic steatohepatitis in Sri Lanka [6]. Colorectal carcinoma, a common malignancy to give rise to secondary liver metastasis, is also rising due to the changing population demographics [7,8]. In Sri Lankan practice, microwave ablation is gaining popularity in treating solid liver tumours. However, there is hardly any data on immediate outcomes after MWA of solid liver lesions from Sri Lanka. This study analyses a cohort of patients' tumour characteristics and outcomes at six weeks following MWA for solid liver tumours

Method

The study is a retrospective analysis of prospectively collected data at Colombo North Center for Liver Diseases, Ragama, Sri Lanka, and selected non-government institutions in Colombo, Sri Lanka (Durdans Hospital, Colombo, Nawaloka Hospital, Colombo, Lanka Hospital, Colombo), where this procedure is performed. The same team conducted it in all the institutions. Diagnosis of HCC was made based on APASL guidelines, and the same was followed as a general guide for management [9, 10]. The best management option

was decided in a multi-disciplinary team meeting comprising a hepatologist, hepatobiliary surgeons, and an interventional radiologist. Patients who underwent MWA for the first time as the primary treatment were included.

Microwave ablation technique

Microwave ablation was performed in the percutaneous route using ECO 100E microwave therapeutic system®. This system has four components; a power generator, a power distribution system, an applicator, and a cooling system. The power generator generated a high-frequency (2.45GHz) electromagnetic field. 14G, 15cm, or 20cm long ceramic antenna was used as the applicator in each patient. 0.9% Sodium Chloride circulation was used as the cooling system. The amount of Watts and the duration of application were determined using the maximum diameter of the tumour according to the ECO guideline. The higher the diameter is, the higher the amount of Watts and duration of ablation needed.

All the procedures were done under ultrasound guidance using a Mindray Resona R9® machine. As all the patients had a single lesion, only one anterior abdominal wall puncture was made in each of them to gain access.

Each patient underwent the ablation under sedation with Midazolam 1mg and Fentanyl 20-100mg. Post-op monitoring was done as per the standard practice, including oxygen saturation monitoring for 1 hour. Oxygen was provided if saturation dropped below 94%. The patient was discharged on the same day in the absence of complications.

Follow-up

Each patient was reviewed at two weeks to assess post-procedure complications. In this assessment, the presence of at least one of the symptoms/signs out of fever (temperature above 38.0 C), abdominal pain other than the pain at the site of the procedure, nausea, and vomiting in the first five days following the process was considered as 'Post ablation syndrome of liver' (PASL) [11, 12]. A follow-up imaging was performed at six weeks. CECT abdomen or MRI abdomen was performed as the preferred mode of imaging. During the assessment, response to treatment was defined as the absence of residual or recurrent tumours. If any degree of pre-ablation arterial phase enhancement or venous phase wash-off was persistent in the follow-up imaging, it was considered a residual lesion. If there was a newly detected arterial phase enhancement or/and venous phase wash-off in the follow-up imaging, that was considered a recurrent tumour [9].

Data collection

Data was gathered retrospectively using an interviewer-administered questionnaire. Data were recorded at discharge from the hospital, two weeks, and six weeks of assessment.

Data analysis

Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 26. Demographic details, background liver status, tumour factors, symptoms, and outcome were described using percentages, means, and medians. The associations between the outcome and the demographic details, background liver status, tumour factors, and procedural factors were analyzed using Cox regression analysis and the Chi-Squared test, where a p-value less than 0.05 was considered statistically significant.

Results

Fifty-five patients (45 males, 81.8%) underwent MWA for liver tumours from October 2021 to May 2022. The median age was 64 (40 – 82) years. One patient (1.8%) underwent MWA for liver metastases from colorectal carcinoma. All the others had HCC in a cirrhotic liver. The median tumour diameter was 28 mm (10 mm – 80 mm). The mean post-procedural hospital stay was 12 hours (6-24 hours, 95%CI=11.4-12.5, SD=2.0).

Most patients had only one lesion (40 patients, 72.7%), while the total number of lesions was 81. The most commonly involved liver segment is segment 7 (14 patients, 25.5%). In our cohort, most of the patients were child class A (41 patients, 74.5%). Most patients were T1b (36 patients, 65.5%). The complete ablation rate was 84.8% in tumours smaller than 3cm, compared to 81.8% in tumours larger than 3cm (Table 1).

Patients (3.6%) did not undergo follow-up CECT or MRI due to personal preferences. In others, 46 patients (83.7%) were found to have complete ablation. Seven patients (12.7%) were found to have a residual tumour. Two patients (3.6%) were found to have new lesions at a 6-week follow-up (Table 2).

Ablations done in Segment 6 were 100% complete. Segment 1 showed the lowest (50%) completion rate. Ablations done for the tumours sized 00-10mm were 100% complete. Ablations done for the tumours larger than 40mm were 100% incomplete. Tumour stage T1a tumours show a 100% ablation rate.

The incidence of immediate complications was assessed. Abdominal pain other than the pain at the site of the lesion was complained by four patients (7.3%). 2 patients (3.6%) developed fever (temperature above 38°C). Nausea and vomiting were complained by four patients (7.3%). PASL developed in 9 patients (16.4%). There were no major complications. One of them died two weeks following the procedure due to complications of liver decompensation (Table 3).

Discussion

In our cohort of patients, 83.7% achieved complete ablation. The best results were seen in Segment 6 while worse in Segment 1. Post-ablation syndrome was reported in 16%, while there was one mortality.

Previous data reported a complete ablation rate of over 95% [13, 14, 15]. The success of the procedure depends on technical accuracy and tumour characteristics. In our study, MWA was performed under ultrasound guidance. However, in previous studies, contrast-enhanced ultrasound scans and fusion imaging have been utilized to increase the accuracy of needle placement. The fusion imaging overlays the real-time US images with previously acquired CT or MRI images [1]. The fusion technology has shown superior results in tumours smaller than 3cm [16, 17]. In the present study, only the percutaneous route was used for MWA. In addition to the percutaneous route, laparoscopic and open approaches have been used to increase the accuracy [13, 14, 18].

This cohort's median tumour size was 2.8cm, comparable to previously published data [1]. As per available data, tumours smaller than 3cm are most likely to be ablated entirely compared to larger tumours [19]. This cohort achieved a higher complete ablation rate in patients with tumours smaller than 3cm. According to *Baker et al* [14], segment 8 was the most commonly ablated segment with HCC. In our experience, segment 7 was the most frequently ablated, followed by Segment 8. However, the highest success rate was achieved in segment 6 and the lowest in segment 1. We used USS as the preferred mode of image guidance. Segment 5 and 6 are located at the lower right side of the liver and has minor interference with the rib cage and the pleural space during needle placement. Whether simple USS guidance gives comparative results to advance image guidance in lower liver segments needs further evaluation.

Livraghi et al. [3] reported major complication rates of around 2.9 % and minor complication rates of around 7.3%. *Liu et al.* [4] reported 4.6% of major complications in their series. However, in our series, there were no direct

mechanical complications reported. PASL was seen in 16.4%, slightly lower in comparison [11, 12]. There was one mortality (1.8 %) in our patients. This patient developed post-procedure hepatic decompensation complicated by worsening pre-existing cardiac abnormality with a chest infection. Mortality with MWA was reported to be 0-0.36% [3].

In Sri Lanka, infrastructure for advanced image guidance facilities is yet to be developed. With available simple ultrasound technology, MWA gives good immediate peri-procedure results in solid liver tumours, especially in the right lower segment liver tumours, and is cheaper than alternative surgery. Our study has its strengths and limitations. This study was conducted at four centres, increasing the generalizability of our results. As a limitation, the number of patients involved was low, which was unavoidable because it is a relatively newer technique in Sri Lanka.

References

1. Amabile C, Ahmed M, Solbiati L, Meloni MF, Solbiati M, Cassarino S, Tosoratti N, Nissenbaum Y, Ierace T, Goldberg SN. Microwave ablation of primary and secondary liver tumours: ex vivo, in vivo, and clinical characterisation. *International Journal of Hyperthermia*. 2017 Jan 2;33(1):34-42. doi.org/10.1080/02656736.2016.1196830
2. Fang C, Cortis K, Yusuf GT, Gregory S, Lewis D, Kane P, Peddu P. Complications from percutaneous microwave ablation of liver tumours: a pictorial review. *The British Journal of Radiology*. 2019 Jul;92(1099):20180864. doi.org/10.1259/bjr.20180864
3. Livraghi T, Meloni F, Solbiati L, Zanus G. Complications of microwave ablation for liver tumors: results of a multicenter study. *Cardiovascular and interventional radiology*. 2012 Aug;35(4):868-74. doi.org/10.1007/s00270-011-0241-8
4. Liang P, Wang Y, Yu X, Dong B. Malignant liver tumors: treatment with percutaneous microwave ablation—complications among cohort of 1136 patients. *Radiology*. 2009 Jun;251(3):933-40. doi.org/10.1148/radiol.2513081740
5. Liu SR, Liang P. Complications of Microwave Ablation for Liver Tumors. In *Microwave Ablation Treatment of Solid Tumors 2015* (pp. 65-76). Springer, Dordrecht. doi.org/10.1007/978-94-017-9315-5_6
6. Bulathsinhala BK, Siriwardana RC, Gunathilake MB, Niriella MA, Dassanayake AS. Clinical characteristics and outcomes of hepatocellular carcinoma: results from prospective study, from a tertiary referral center in Sri Lanka. doi.org/10.4038/cmj.v63i3.8724

7. Perera T, Wijesuriya R, Suraweera PH, Wijewardene K, Kumarage S, Ariyaratne MH, Deen K. The prevalence of colorectal cancer and survival in patients from the Gampaha District, North Colombo region. *Ceylon Medical Journal*. 2008 Dec 9;53(1). doi.org/10.4038/cmj.v53i1.221

8. Chandrasinghe PC, Ediriweera DS, Hewavisenthi J, Kumarage SK, Fernando FR, Deen KI. Colorectal cancer burden and trends in a South Asian cohort: experience from a regional tertiary care center in Sri Lanka. *BMC Research Notes*. 2017 Dec;10(1):1-5. doi.org/10.1186/s13104-017-2869-1

9. Tan CH, Low SC, Thng CH. APASL and AASLD consensus guidelines on imaging diagnosis of hepatocellular carcinoma: a review. *International journal of hepatology*. 2011 Jan 1;2011. doi.org/10.4061/2011/519783

10. Heimbach JK, Kulik LM, Finn RS, Sirlin CB, Abecassis MM, Roberts LR, Zhu AX, Murad MH, Marrero JA. AASLD guidelines for the treatment of hepatocellular carcinoma. *Hepatology*. 2018 Jan;67(1):358-80. doi.org/10.1002/hep.29086

11. Ianniello A, Carrafiello G, Laganà D, Fontana F, Nicotera P, Fugazzola C. Post-radiofrequency ablation syndrome after percutaneous radiofrequency of abdominal tumours. *European Congress of Radiology-ECR 2008*. doi.org/10.1111/j.1440-1673.2007.01871.x

12. Dodd III GD, Napier D, Schoolfield JD, Hubbard L. Percutaneous radiofrequency ablation of hepatic tumors: postablation syndrome. *American Journal of Roentgenology*. 2005 Jul;185(1):51-7. doi.org/10.2214/ajr.185.1.01850051

13. Groeschl RT, Wong RK, Quebbeman EJ, Tsai S, Turaga KK, Pappas SG, Christians KK, Hohenwarter EJ, Tutton SM, Rilling WS, Gamblin TC. Recurrence after microwave ablation of liver malignancies: a single institution experience. *Hpb*. 2013 May;15(5):365-71. doi.org/10.1111/j.1477-2574.2012.00585.x

14. Baker EH, Thompson K, McKillop IH, Cochran A, Kirks R, Vrochides D, Martinie JB, Swan RZ, Iannitti DA. Operative microwave ablation for hepatocellular carcinoma: a single center retrospective review of 219 patients. *Journal of Gastrointestinal Oncology*. 2017 Apr;8(2):337. doi.org/10.21037/jgo.2016.09.06

15. Imajo K, Tomeno W, Kanezaki M, Honda Y, Kessoku T, Ogawa Y, Yoshida K, Yoneda M, Kirikoshi H, Ono M, Kaneta T. New microwave ablation system for unresectable liver tumors that forms large, spherical ablation zones. *Journal of Gastroenterology and Hepatology*. 2018 Dec;33(12):2007-14. doi.org/10.1111/jgh.14294

16. Lee MW, Kim YJ, Park HS, Yu NC, Jung SI, Ko SY, Jeon HJ. Targeted sonography for small hepatocellular carcinoma discovered by CT or MRI: factors affecting sonographic detection. *American Journal of Roentgenology*. 2010 May;194(5):W396-400. doi.org/10.2214/ajr.09.3171

17. Minami Y, Chung H, Kudo M, Kitai S, Takahashi S, Inoue T, Ueshima K, Shiozaki H. Radiofrequency ablation of hepatocellular carcinoma: value of virtual CT sonography with magnetic navigation. *American Journal of Roentgenology*. 2008 Jun;190(6):W335-41. doi.org/10.2214/ajr.07.3092

18. Della Corte A, Ratti F, Monfardini L, Marra P, Gusmini S, Salvioni M, Venturini M, Cipriani F, Aldrighetti L, De Cobelli F. Comparison between percutaneous and laparoscopic microwave ablation of hepatocellular carcinoma. *International Journal of Hyperthermia*. 2020 Jan 1;37(1):542-8. doi.org/10.1080/02656736.2020.1769869

19. Widmann G, Bodner G, Bale R. Tumour ablation: technical aspects. *Cancer Imaging*. 2009;9(Special issue A):S63. doi.org/10.1102/1470-7330.2009.9026

Table 1- Tumour characteristics of the patients

Character	Patients	Percentage with complete ablation
Number of lesions [81]		
1 lesion	40 (72.7%)	82.50%
More than 1 lesion	15 (27.3%)	86.60%
Involvement of segments		
Seg1	2 (3.8%)	50%
Seg2	7 (13.4%)	71.40%
Seg3	5 (9.6%)	60%
Seg4	5 (9.6%)	80%
Seg5	9 (17.3%)	88.80%
Seg6	6 (11.5%)	100%
Seg7	18 (34.6%)	88.80%
Seg8	17 (30.6%)	94.10%
Child Turcott Pugh Score		
Non -Cirrhotic	1 (1.8%) Colorectal carcinoma patient	100%
A	41 (74.5%)	87.80%
B	9 (16.4%)	66.60%
C	4 (7.3%)	100%
Size range		
00-10mm	01 (1.8%)	100%
11-20mm	12 (21.8%)	83.30%
21-30mm	20 (36.3%)	85%
31-40mm	20 (36.3%)	90%
More than 40mm	02 (3.6%)	0%
[Less than 3cm]	33	84.80%
[3cm or larger]	22	81.80%
Tumour stage		
T1a	04 (7.3%)	100%
T1b	36 (65.5%)	83.30%
T2	15 (27.2%)	86.60%

Table 2 – Primary outcome of the microwave ablation assessed in the 6-week follow-up

The outcome in 6 weeks	Number of patients
Complete ablation	46 (83.7%)
Residual tumour	7 (12.7%)
Denied CECT or MRI	2 (3.6%)

Table 3- Complications of microwave ablation

Complication	Number of patient	Percentage
Abdominal pain	4	7.3
Fever	2	3.6
Nausea and vomiting	4	7.3
Post ablation syndrom	9	16.4
Mechanical complicati	0	0