ABSTRACT

This article demonstrates the technique of using a coaxial guiding needle to perform combined percutaneous biopsy and microwave ablation via a single tract. From May 2019 to July 2020, 14 patients underwent combined biopsy and microwave ablation by using a coaxial guiding cannula. Tumors were in the kidney of six patients (43%), the liver of six patients (43%), and the lung in two patients (14%). The diagnostic yield of biopsy was 86% (12/14). Ablation technical success rate was 100%. In conclusion, using a coaxial guiding needle in microwave ablation and biopsy is safe and effective.
INTRODUCTION

In recent years, imaging-guided ablation has been used to treat tumors in different organs. Among several modalities of thermal ablation, microwave ablation (MWA) has been proven to be safe and effective in treating tumors in the liver, kidney, and lung [1–3].

Combined coaxial biopsy and ablation is such a common practice for radiofrequency ablation (RFA) [4] that an RFA device with an insulated guiding cannula is commercially available (LeVeen, Boston Scientific). At present however, there is no commercially available MWA system that provides a guiding cannula compatible with coaxial biopsy and MWA.

The aim of this article is to describe the technique of using a coaxial guiding needle to perform combined biopsy and MWA via a single path and to evaluate its feasibility.

TECHNIQUE

A 17G/20 cm MWA antenna (PR 20 probe, NeuWave Medical) can be inserted coaxially through the 14G/11.6 cm guiding cannula (Figure 1A).

During MWA procedure, a 14G/11.6 cm guiding needle was advanced into or near the tumor under ultrasound or computer tomography (CT) guidance. The inner stylet of the guiding needle was removed. Biopsy was performed with a 16G/15 cm needle coaxially through the guiding cannula. Subsequent MWA was performed with 17G/20 cm MWA antenna inserted coaxially through the guiding cannula (Figure 1B).

PATIENTS

A total 14 consecutive patients underwent combined percutaneous biopsy and imaging-guided MWA from May 2019 to July 2020.

Technical success is defined when tumor was treated according to MWA protocol of the chosen antenna and was covered completely by ablation zone immediately after the procedure. Complications were graded based on the Cardiovascular and Interventional Radiological Society of Europe (CIRSE) classification system [5].

Patients’ characteristics and procedure details are summarized in Table 1. Overall diagnostic yield of percutaneous biopsy was 86% (12/14). Technical success was 100%. Of the 14 patients who underwent combined biopsy and MWA, two developed mild complications (14%).

Figure 1 (A) Top to bottom: inner stylet of the guiding needle, 14G/11.6 cm guiding cannula, 16G biopsy needle and 17G/20 cm MWA antenna. (B) A MWA antenna inserted through guiding cannula. Tip of the guiding cannula is indicated by the arrow. (C) CT showed a 0.8 cm metastatic nodule in the left lower lobe. (D) Microwave ablation (MWA) was performed by MWA antenna inserted through the 14G guiding cannula (arrow). (E) Post procedure CT demonstrated satisfactory penumbra covering the nodule (arrow).
| NUMBER | AGE | SEX | ONCOLOGY HISTORY | LOCATION OF TUMOR | INDICATION OF BIOPSY | HISTOLOGY | MAXIMAL DIAMETER OF TUMOR (CM) | IMAGING GUIDANCE | NUMBERS OF ANTENNA | TECHNICAL SUCCESS | TRACT ABLATION OR EMBOLISATION | COMPLICATION, GRADE |
|--------|-----|-----|------------------|-------------------|----------------------|-----------|--------------------------------|------------------|--------------------|-----------------|------------------------|-----------------|
| 1      | 90  | F   | Colonic adenocarcinoma | Liver, segment III | Confirm metastasis | Focal regeneration | 0.8                | US               | 1                 | Yes         | No                      | No              |
| 2      | 64  | M   | No                | Kidney, right upper pole | Confirm malignancy | Papillary RCC | 1.5                | CT               | 1                 | Yes         | Tract ablation        | No              |
| 3      | 53  | F   | Colonic adenocarcinoma | Liver, segment III | Confirm metastasis | Non-diagnostic | 2.0                | US               | 1                 | Yes         | Tract ablation        | No              |
| 4      | 78  | M   | No                | Liver, segment VI | No risk factor for HCC | HCC | 1.6                | US               | 1                 | Yes         | No                      | No              |
| 5      | 65  | M   | No                | Kidney, left lower pole | Confirm malignancy | Non-diagnostic | 1.8                | US               | 1                 | Yes         | Tract embolisation and ablation | No              |
| 6      | 68  | M   | No                | Liver, segment VVI | No risk factor for HCC | HCC | 2.5                | US               | 1                 | Yes         | Tract ablation        | No              |
| 7      | 59  | F   | No                | Liver, segment VII | No risk factor for HCC | Focal lobular inflammation | 1.0                | CT               | 1                 | Yes         | Tract ablation        | No              |
| 8      | 76  | M   | No                | Kidney, right upper pole | Confirm malignancy | Papillary RCC with sarcomatoid change | 4.2                | CT               | 2                 | Yes         | Tract ablation        | No              |
| 9      | 81  | M   | No                | Kidney, left lower pole | Confirm malignancy | Clear cell RCC | 3.5                | US               | 2                 | Yes         | No                      | No              |
| 10     | 72  | M   | No                | Liver, segment III | No risk factor for HCC | HCC | 1.6                | US               | 1                 | Yes         | No                      | No              |
| 11     | 79  | M   | No                | Kidney, left upper pole | Confirm malignancy | Papillary RCC | 3.0                | CT               | 2                 | Yes         | No                      | No              |
| 12     | 78  | M   | No                | Kidney, right interlobar region | Confirm malignancy | Clear cell RCC with sarcomatoid change | 3.4                | CT               | 2                 | Yes         | Ablation of psoas muscle with no clinical symptom, 1 | No              |
| 13     | 86  | M   | Colonic adenocarcinoma | Lung, left lower lobe | Confirm metastasis | Metastatic adenocarcinoma | 1.0                | CT               | 1                 | Yes         | Tract embolisation    | No              |
| 14     | 79  | M   | Cholangiocarcinoma | Lung, left upper lobe | Confirm metastasis | Metastatic adenocarcinoma | 0.6                | CT               | 1                 | Yes         | Tract embolisation    | Small pneumothorax, resolved within 48 hours, 2 |

Table 1 Patient characteristics, procedure details and outcome.
F female, M male, US ultrasound, CT computer tomography, HCC hepatocellular carcinoma, RCC renal cell carcinoma.
DISCUSSION

In our experience, combining biopsy and MWA through the same guiding cannula is relatively easy to perform. There are several advantages to using this technique. Firstly, biopsy is performed immediately prior to the placement of the MWA antenna. This allows the operator to better visualize and target the lesion, especially if the procedure is performed under ultrasound guidance. Using this technique, biopsy is performed by a needle with a larger diameter (16G), which may increase the diagnostic yield, as smaller needles (18G) are commonly used in tandem fashion. The biopsy diagnostic yield in our case series was 86%. Secondly, puncture-site complications (bleeding, pneumothorax, and tract seeding) are reduced, as the coaxial technique allows for performing two procedures via only one single path [4, 6]. Lastly, the coaxial guiding cannula allows for injecting a hemostatic agent to embolize the tract once ablation is completed. This is particularly useful in lung ablation, as tract embolization may reduce pneumothorax rate after the procedure [7].

One of the limitations of using this technique is the risk of performing MWA on benign lesions if the histology result is not readily available. An additional limitation is that the biopsy of a small lung nodule may cause significant alveolar hemorrhage, which may hinder the subsequent placement of MWA antenna. To overcome this, the tip of the guiding cannula can be advanced over the biopsy needle to the distal margin of the nodule. Once the biopsy needle is removed, the tip of the MWA antenna is advanced to the tip of the cannula. Maintaining the position of the MWA antenna, the guiding cannula is slowly pulled back to expose the active tip of the MWA antenna. In that case, the tip of the MWA antenna is always at the distal margin of the nodule regardless of the presence of hemorrhage.

In conclusion, using a coaxial guiding needle in MWA was safe and effective in obtaining a biopsy prior to the MWA procedure via a single path.

COMPETING INTERESTS

The authors have no competing interests to declare.

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