Preliminary experience with microwave ablation for selective feticide in monochorionic twin pregnancies

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Microwave ablation (MWA) is an alternative technique to radiofrequency ablation and laser ablation in the treatment of some solid tumors. In contrast to radiofrequency and laser ablation, we are not aware of previous experiences with MWA in fetal procedures, and report here our preliminary experience.

Two cases of monochorionic–diamniotic twins, discordant for fetal abnormalities, underwent selective feticide by MWA between November 2011 and March 2012. Both patients were informed about the nature of the treatment and possible alternatives and gave their written informed consent. MWA was performed using a 2.45-MHz generator (AMICA-GEN, HS Hospital Service, Aprilia, Italy) delivering energy through a 16-gauge internally cooled coaxial antenna. All the procedures were performed percutaneously under ultrasound guidance. Conscious sedation (delorazepam, 5 mg intravenously) and local anesthetic (10 mL of 2% lidocaine) were administered. The antenna was centered in the abdomen of the abnormal fetus close to the insertion of the umbilical cord (Figure 1a). A single microwave energy application was delivered at 50 W net power at the applicator end for 3 min. In both cases, MWA was technically easy, and ultrasound evidence of tissue coagulation was seen immediately after the beginning of energy delivery (Figure 1b).

In the first case, one of the twins had a complex cardiac abnormality (dextrocardia, tricuspid atresia, ventricular septal defect, pulmonary stenosis) complicated by hydrops; cervical length was 22 mm. MWA was performed at 17 + 3 weeks' gestation. There was premature rupture of membranes of the terminated twin 4 days later, and the entire pregnancy miscarried after 7 days.

In the second case, one of the twins had anencephaly; cervical length was 40 mm. MWA was performed at 16 + 2 weeks. The pregnancy carried on uneventfully, and a healthy female infant was delivered vaginally at 39 weeks' gestation.

MWA has many potential advantages over radiofrequency and laser ablation: there is immediate evidence of tissue coagulation on ultrasound; the technique is less dependent on tissue properties, as microwave energy heating is not limited by deficient conduction of energy through bone, vessels or charred tissue as with radiofrequency ablation[1,2]; MWA can coagulate larger targets than radiofrequency and laser ablation, or similar targets in a shorter time[3]; and finally, blood vessels in the coagulation area do not create ablation-zone distortion because of the minimal heat sink effect[4,5].

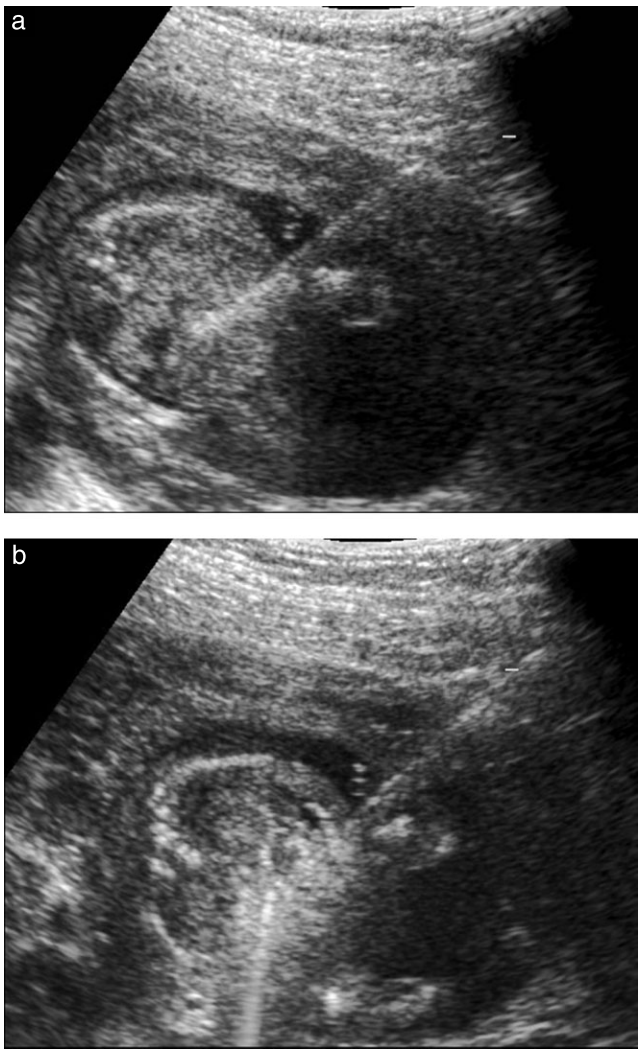

Figure 1 Ultrasound images showing microwave ablation in Case 2. (a) Antenna is centered in abdomen of abnormal fetus close to insertion of umbilical cord. (b) Two min after start of energy delivery, evidence of tissue coagulation can be seen.

To avoid extension of thermal damage, according to the manufacturer's suggestions we used a power setting of 50 W for 3 min, whereas most procedures, for liver neoplasms for example, use power in excess of 60–80 W for as long as 10 min[4]. In procedures performed on liver tumors, MWA has been shown to be at least as safe as radiofrequency ablation[6]. While heating should ideally be perfectly spherical around the end of the antenna, most interstitial antennae create a more ellipsoidal or teardrop-shaped pattern[1]. Taking this into account, we targeted the fetal abdomen from the side to increase the efficacy of occluding the umbilical arteries and vein.

In conclusion, our preliminary experience shows that MWA is applicable to intrafetal procedures. Further

evaluation in *ex vivo* or animal models, and in larger clinical series, is required.

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