자궁 근종에 대한 HIFU 치료 후 발생한 하부 복부의 심부 화상

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Deep Burn Injuries on the Lower Abdomen after HIFU Treatment for Uterine Myoma

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High-intensity focused ultrasound (HIFU) has been regarded as a non-invasive uterine-preserving treatment for women with uterine myoma. Numerous studies have reported that it is a relatively safe and effective treatment for uterine myoma. However, severe complications, such as deep thermal burn injuries, bowel perforation, and bladder injury, were reported on rare occasions. We report a case of a 4th degree burn on the lower abdomen after HIFU treatment for uterine myoma. Physicians must consider the possibility of deep thermal burn injuries when managing uterine myoma with HIFU. (**J Korean Burn Soc 2020;23:64-67**)

Key Words: HIFU, Burns, Uterine myoma

INTRODUCTION

High-intensity focused ultrasound (HIFU) is a non-invasive ultrasound technique that focuses and transmits ultrasound beams through solid body tissues resulting in bio-effects that can destroy and coagulate deeper tissues by thermal effects and cavitation [1]. The possibility of HIFU as a local thermal ablation technique was first introduced in the 1940s [2]. HIFU treatment is also offered as a potential therapeutic option to women of child-bearing age with symptomatic myoma. Treatment of myoma using HIFU is an organ-sparing, thermoablative procedure applied transcutaneously. In this procedure, the myoma, under continuous MRI monitoring, is gradually heated in small, focused stages, until temperatures greater than 55°C are reached to achieve complete denaturation

of the localized tumor. The high energy concentration in a very small, ellipsoid focus to create discrete areas of tissue necrosis preserves both adjacent tissue and the structures between the energy source and the target tissue [3].

HIFU has been thought to be a generally safe modality for solid tumors. However, the heat diffusion out of the target can cause problems by damaging adjacent tissues.

We report a case of a 4th degree burn on the lower abdomen after HIFU treatment for uterine myoma. The aim of this case report is to inform other physicians of an uncommon severe thermal complication from HIFU treatment.

CASE REPORT

A 46-year-old female patient visited a local gynecology hospital due to multiple (5.6×4.0 cm, 1.3×1.3 cm, 1.0×1.0 cm) uterine myoma, and received HIFU (JC200D, CHONGQING HAIFU MEDICAL TECHNOLOGY CO., LTD, China) treatment on May 28, 2019. 6 days after the HIFU procedure, she visited our clinic with a 6×4 cm sized deep dermal burn on her lower abdomen including the upper portion of the suprapubic area (Fig. 1). Burn dressing was

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Fig. 1. (A) Gross photographs showed 6×4 cm sized, sharply demarcated, progressive thick eschars on lower abdomen including upper portion of suprapubic area on post-HIFU day 6, (B) and post-HIFU week 3.

Fig. 2. (A) The APCT on 4 weeks postburn showed diffuse fatty infiltration at the lower abdominal wall. (B) The APCT on 7 weeks postburn showed newly appeared abdominal defects about 6×4 cm in size on the lower abdomen involving skin, subcutaneous fat and a portion of both lower rectus abdominis muscles and left pectineus muscle. (C) The APCT on 4 weeks postburn showed normal pubic symphysis, but inflammatory edema within the adjacent soft tissues. (D) The APCT on 7 weeks postburn showed newly developed septic arthritis in the pubic symphysis and osteomyelitis in both adjacent pubic bones.

done once every two days. On 4 weeks postburn, the abdominopelvic computed tomography (APCT) showed diffuse fatty infiltration in the lower abdominal wall. On 7 weeks postburn, the APCT showed an approximately 6×4 cm sized abdominal wall defect in the lower abdomen involving skin, subcutaneous fat, and a portion of both lower rectus abdominis muscles and left pectineus muscle. The size of uterine myoma had not decreased (Fig. 2). On 8 weeks postburn, the magnetic resonance imaging (MRI) showed septic arthritis in the pubic symphysis with small abscess formation and osteomyelitis with a pathologic fracture. On 8 weeks postburn, surgical debridement of the infected pubic bone was done. Then daily copious saline irrigation was done using broad spectrum antibiotics, and vacuum assisted closure (VAC) dressing with V.A.C.[®]

(Kinetic Concepts, Inc., USA) was applied every third day. After two months of VAC dressing, the wound showed improvement (Fig. 3). On 15 weeks postburn, a local advancement skin flap was elevated and transferred to cover the exposed pubic bone and abdominal skin defect. At 23 days postoperatively, the abdominal full-thickness skin defects were well reconstructed without complications (Fig. 4).

DISCUSSION

Common complications reported after HIFU therapy include superficial skin burns, skin disruptions, subcutaneous edema, lower abdominal pain, sciatic pain, and vaginal discharge with small amounts of vaginal bleeding.

Fig. 3. (A) On 8 weeks postburn, the MRI showed septic arthritis in the pubic symphysis with small abscess formation and osteomyelitis with a pathologic fracture. (B) On 7 weeks postburn, gross photographs showed about 5×4 cm sized abdominal skin defect. (C) On 15 weeks postburn, after the surgical debridement of infected pubic bone, VAC dressing was applied on every third day. (D) On 16 weeks postburn, gross photograph showing the wound was much more improved.

Fig. 4. (A, B) On 15 weeks postburn, the fasciocutaneous advancement flap was elevated and transferred to cover the exposed pubic bone and abdominal skin defect. (C) At 23 days postoperatively, the lower abdominal skin defects caused by HIFU were well healed without complications. (D) 18 weeks after HIFU, the ultrasonography showed the size of uterine myoma had not decreased since previously studied.

In addition, severe complications, such as deep dermal burns requiring surgical repair, bowel perforation, bladder injuries, and deep vein thrombosis, were also reported [4].

In general instructions in the US beam path, the patients with myoma close to the sacral bone surface, with extensive cutaneous scars, or with bowel interposition

should be strictly excluded from HIFU treatment. Also, the presence of concomitant severe adenomyosis, pedunculated subserosal myoma with a pedicle less than 50% of total myoma diameter, or multiple myomas counting more than five in numbers or over 10 cm in size should also be considered as factors limiting treatment using magnetic resonance-guided HIFU therapy. However,

there is lack of organized criteria about indications or contraindications of US-guided HIFU [5]. In recent years, numerous studies have been conducted about the factors that contribute to HIFU treatment complications. The reflection of ultrasound caused by bones can deposit ultrasonic energy in skin and subcutaneous layers, resulting in skin burns, especially when targeting tumors in the upper abdomen and lower abdomen with HIFU. Also, absorption of ultrasonic energy by HIFU can damage tissues in the HIFU path and hurt the adjacent tissues. The difference in acoustic impedance can result in different distributions of energy into tissues and cause damage to the tissue in the interface [6]. Canney et al. (2010) demonstrated that localized heating by shockwaves at the HIFU focus can raise tissue temperatures to 100°C in a few milliseconds, resulting in the formation of a boiling vapor bubble at the HIFU focus [7]. This bubble then grows to a millimeter in size, and may destroy adjacent tissue because of shear stresses produced around the oscillating bubble [8]. Some studies have been conducted about the mechanism of boiling histotripsy to help predict the size of a mechanically induced lesion. Pahk et al. (2017) suggested that the overall size of a lesion generated by boiling histotripsy is dependent on the spatial extent of the heated region at the HIFU focus and the backscattered ultrasound wave by the original vapor bubble [9]. Future work needs to be focused on predicting the size of a mechanically induced lesion and the factors that contribute to complications in HIFU treatment.

In our case, a burn injury occurred on the lower abdomen near the pubic symphysis. Septic arthritis in the pubic symphysis and osteomyelitis in both adjacent pubic bones were also observed. These complications were suspected to be as a result of ultrasound reflection. Many studies have reported that most skin burns after HIFU are 1st and 2nd degree. However, even if it looks like a superficial skin burn, physicians must pay attention to progressive deep burn injuries when examining patients with skin burns after HIFU treatment.

Currently, HIFU has been regarded as a non-surgical, minimally invasive therapeutic option for uterine myoma. However, severe complications such as deep burn injuries at the HIFU site, have been reported [10]. For the safe application of HIFU in treating uterine myoma, the safety

verification of HIFU instruments and performing the procedures by experienced practitioners according to standard criteria and guideline are emphasized.

CONFLICTS OF INETEREST

The authors have no financial disclosures or conflicts of interest to declare.

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