

# HDliveFlow with HDlive Silhouette Mode for Diagnosis of Malignant Tumors of Uterine Cervix

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## ABSTRACT

**Objective:** To present our experience of using HDliveFlow with the HDlive silhouette mode to assess malignant tumors of the uterine cervix.

**Materials and methods:** Five women with malignant tumors of the uterine cervix (one case each of malignant lymphoma, cervical cancer stage IIA, and three of cervical cancer stage IVb) were studied using HDliveFlow with the HDlive silhouette mode.

**Results:** In a case of malignant lymphoma of the cervix, HDliveFlow with the HDlive silhouette mode demonstrated a markedly hyper-vascularized uterus with numerous vessels radiating out from the periphery of the uterus to its center (radial-vascular pattern). In four cases of advanced cervical cancer (one case each of stage IIA, and three of stage IVb), HDliveFlow with the HDlive silhouette mode revealed a central hyper-vascular tumor within the peripheral vascular-ring appearance of the cervix, and clearly demonstrated the configuration of the tumor.

**Conclusion:** HDliveFlow with the HDlive silhouette mode may provide useful information on the diagnosis of malignant tumors of the uterine cervix.

**Keywords:** Cervical cancer, HDliveFlow, HDlive silhouette mode, Malignant lymphoma, Uterine cervix.

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**Conflict of interest:** None

## INTRODUCTION

In the female genital tract, primary lymphoma is very rare, and represents less than 1% of cases with an extranodal presentation.<sup>1</sup> As the initial manifestation of lymphoma,

uterine involvement is rare, and its rarity and absence of definitive radiologic features can lead to misdiagnosis.<sup>2</sup> There are also no characteristic features of malignant lymphoma using conventional two-dimensional (2D) or color Doppler ultrasound.<sup>3-7</sup>

There have been numerous studies on conventional three-dimensional (3D) power Doppler ultrasound assessment of cervical cancer.<sup>8</sup> However, the usefulness of 3D power Doppler for the diagnosis of cervical cancer is still controversial.

HDliveFlow represents a new 3D color/power Doppler modality with an adjustable light source, facilitating lighting and shadowing effects, which promote depth perception on 3D blood flow examination.<sup>9</sup> HDliveFlow in conjunction with the HDlive silhouette mode allows spatial visualization of blood vessels in the presence of gynecologic disorders, and the merits of a spatial view of these vessels as well as the visualization of landmarks of adjacent structures are combined.<sup>9-11</sup> To the best of our knowledge, this is the first report on using HDliveFlow with the HDlive silhouette mode to assess malignant tumors of the uterine cervix.

## MATERIALS AND METHODS

Five women with malignant tumors of the uterine cervix (one case each of malignant lymphoma, cervical cancer stage IIA, and three of cervical cancer stage IVb) were studied using HDliveFlow with the HDlive silhouette mode (Voluson E10, GE Healthcare Japan, Tokyo, Japan) with a mechanical transvaginal 3.7–17.5-MHz transducer. This study was approved by the Kagawa University Graduate School of Medicine Ethics Committee, and standardized written informed consent was obtained from all women.

First, the uterus was scanned with 2D sonography and conventional color/power Doppler mode. After switching to 3D color/power Doppler, the region of interest was scanned and stored on the hard drive of the ultrasound machine for subsequent analysis. HDliveFlow was used to obtain a representative vascular tree volume of the uterine cervix. The signal was detected when the blood velocity was higher than the threshold value, which depends on the pulse repetition frequency (PRF) and high-pass filter of the machine. Therefore,

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maximal sensitivity was ensured by setting the PRF to 0.9 kHz and the wall motion filter to “low.” The 3D volume box was positioned over the uterine cervix at a fixed 120° angle. Volume acquisition was carried out within 16 seconds. All volume data for each subject were examined, and optimal images were selected for further analysis. The 3D reconstruction was carried out using HDliveFlow with the HDlive silhouette mode. All HDliveFlow with the HDlive silhouette mode examinations were performed by two examiners (T.H. and M.I.) for the data reported here.

## RESULTS

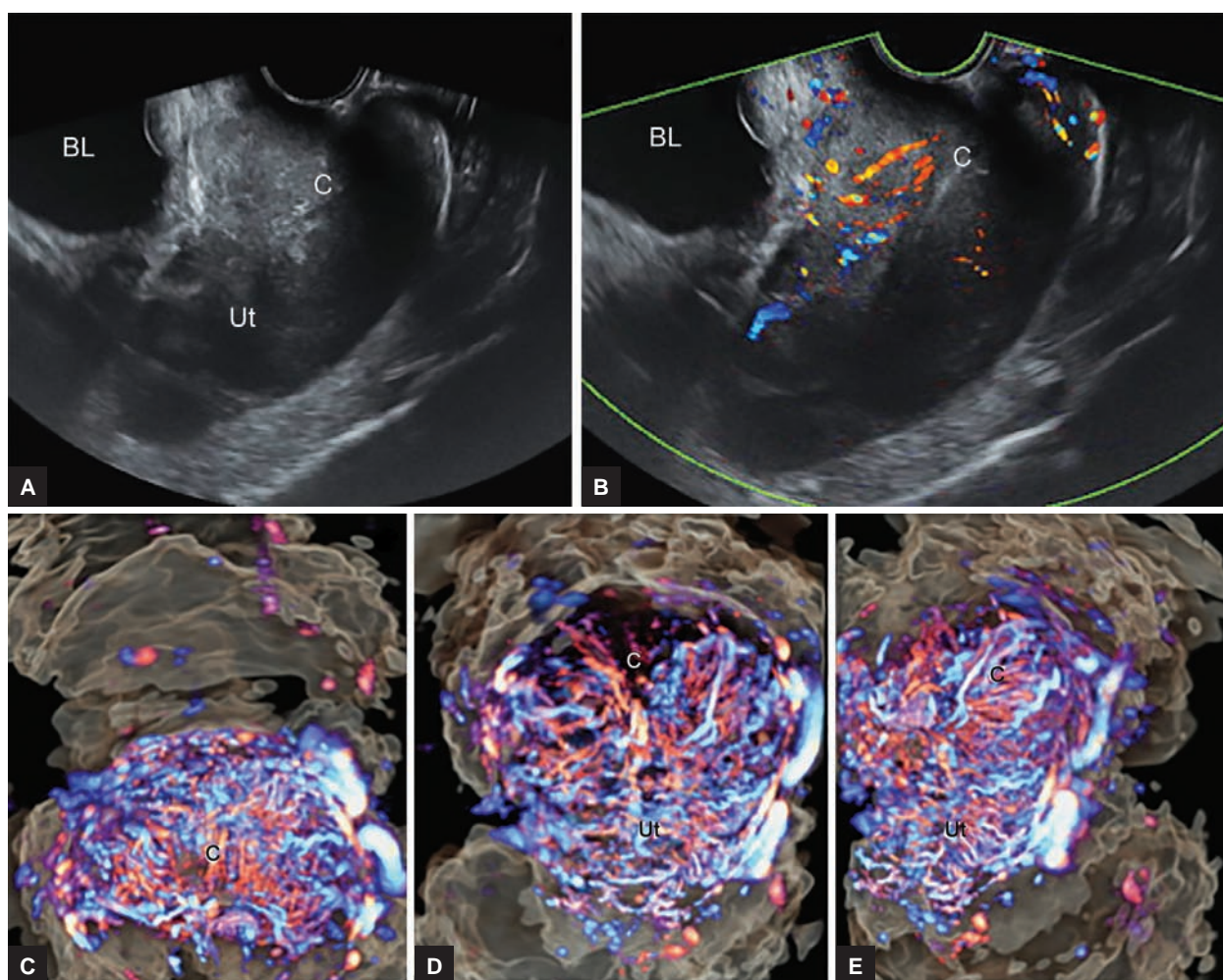
In a case of malignant lymphoma of the cervix, transvaginal 2D sonography (Voluson E8, GE Healthcare Japan, Tokyo, Japan) showed an enlarged hypoechoic cervix with a thickened hyper-echogenic serosa (Fig. 1A). The bladder wall was edematous. Conventional color Doppler revealed moderate vascularity in the cervix (Fig. 1B). However,

HDliveFlow with the HDlive silhouette mode (Voluson E10, GE Healthcare Japan, Tokyo, Japan) demonstrated a markedly hypervascularized uterus with numerous vessels radiating out from the periphery of the uterus to its center (radial-vascular pattern) (Figs 1C, to E).

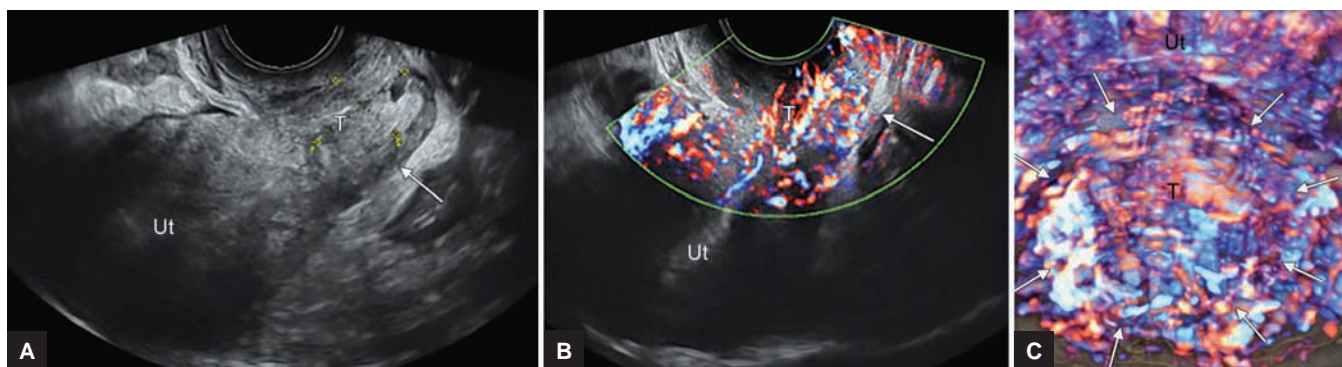
In four cases of advanced cervical cancer (one case each of stage IIA, and three of stage IVb), transvaginal 2D sonography showed a lobulated bulky cervical tumor, and color/power Doppler depicted moderate to abundant blood flow in the cervix (Figs 2A to C to 5A and B). HDliveFlow with the HDlive silhouette mode revealed a central hypervascular tumor within the peripheral vascular-ring appearance of the cervix, and clearly demonstrated the configuration of the tumor (Figs 2A to C to 5A and B).

## DISCUSSION

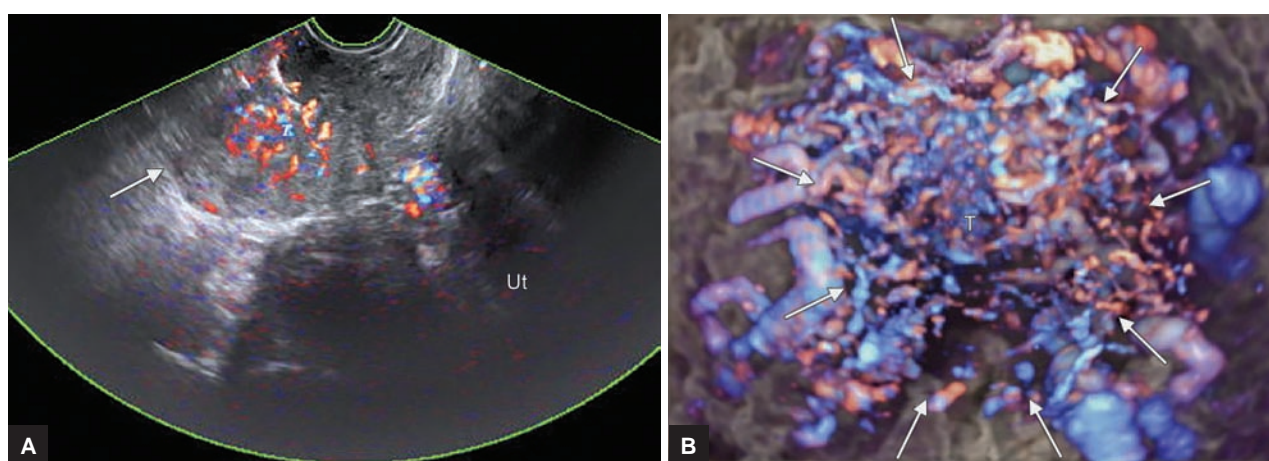
In our previous reports, we found that HDliveFlow with the HDlive silhouette mode may provide information



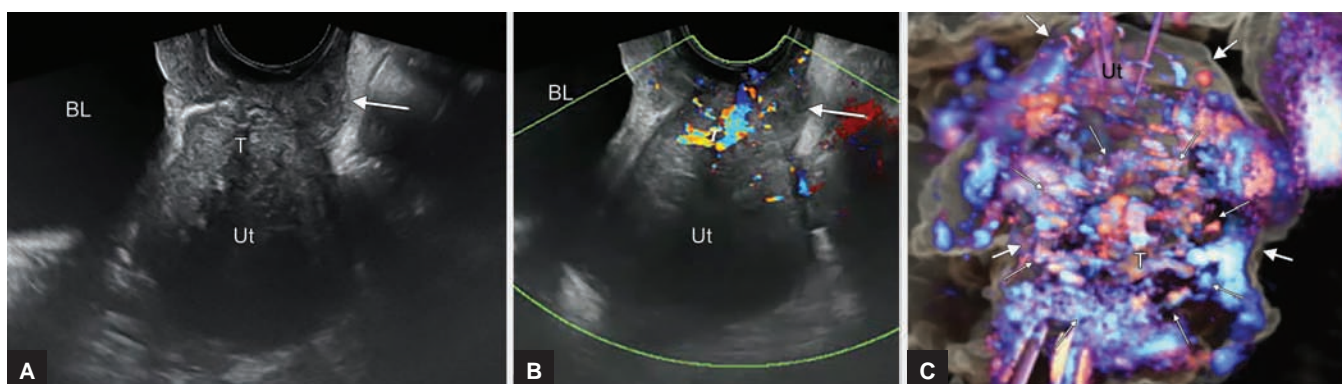
**Figs 1A to E:** Malignant lymphoma of the cervix. Transvaginal 2D sonography shows an enlarged hypoechoic cervix with thickened hyper-echogenic serosa (A) sagittal plane. The bladder wall is edematous. Conventional color Doppler shows moderate vascularity in the uterus (B) sagittal plane. HDliveFlow with the HDlive silhouette mode (C) inferior view; (D) posterior view; and (E) lateral view demonstrates a markedly hyper-vascularized uterus with numerous vessels radiating out from the periphery of the uterus to its center (radial-vascular pattern). BL: Bladder; C: Cervix; Ut: Uterus



**Figs 2A to C:** Invasive cervical cancer (stage IIa). Transvaginal 2D sonography shows a lobulated, bulky cervical tumor (T) (A) sagittal plane), and HD-flow depicts moderate blood flow in the cervix (arrow); (B) sagittal plane. HDliveFlow with the HDlive silhouette mode (inferior view: See through the vagina) reveals a central hyper-vascular tumor within the peripheral vascular-ring appearance of the cervix (arrows); and (C) the HDlive silhouette mode clearly demonstrates the configuration of the tumor (T). Ut: Uterus



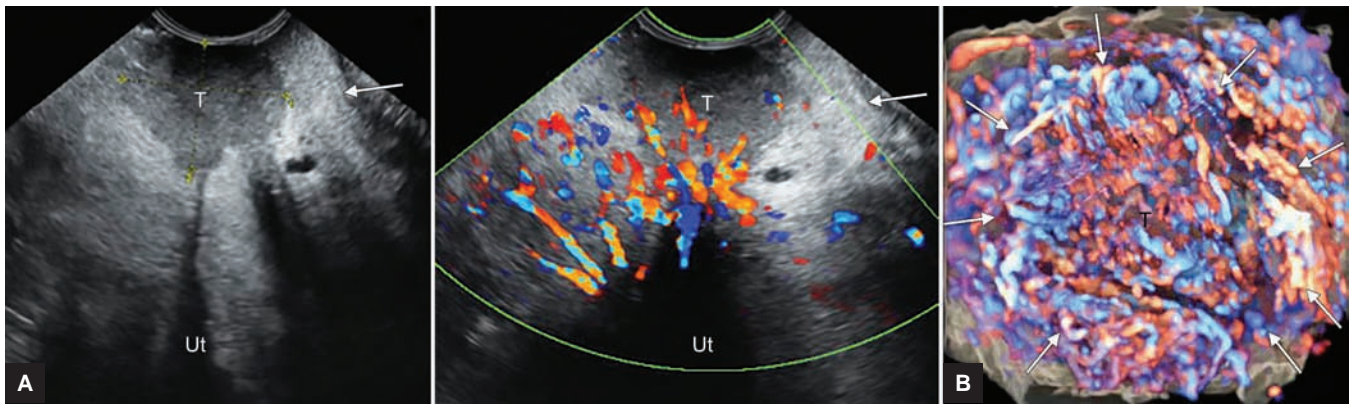
**Figs 3A and B:** Advanced cervical cancer (stage IVb). HD-flow depicts moderate blood flow inside the tumor (T) of the cervix (arrow); and (A) sagittal plane. HDliveFlow with the HDlive silhouette mode (inferior view: See through the vagina) reveals a central hyper-vascular tumor (T) within the peripheral vascular-ring appearance of the cervix (arrows) (B) Ut: Uterus



**Figs 4A to C:** Advanced cervical cancer (stage IVb, locally stage IIIb). Transvaginal 2D sonography shows a bulky cervical tumor (T) (A) sagittal plane, and color Doppler depicts abundant blood flow in the cervix (arrow) (B) sagittal plane. HDliveFlow with the HDlive silhouette mode (inferior view: See through the vagina) reveals a central hyper-vascular tumor (T) within the peripheral vascular-ring appearance of the cervix (small arrows) (C) Large arrows show uterus. BL: Bladder; Ut: Uterus

to aid in the differentiation between primary and metastatic ovarian cancers,<sup>9</sup> be an important, adjunctive tool in the diagnosis as well as follow-up of a uterine artery pseudoaneurysm,<sup>10</sup> and be beneficial as an additional diagnostic tool along with conventional color/power Doppler for the diagnosis of molar pregnancy.<sup>11</sup> In the

present study, this technique clearly demonstrated a novel feature of malignant lymphoma of the cervix (radial-vascular pattern), which was completely different from those of cervical cancers, although 2D sonographic and color/power Doppler ultrasound findings of advanced cervical cancers were almost the same



**Figs 5A and B:** Advanced cervical cancer (stage IVb). Transvaginal 2D sonography shows a lobulated bulky cervical tumor (T) (A) sagittal plane, and color Doppler depicts abundant blood flow inside the tumor (B) sagittal plane. HDliveFlow with the HDlive silhouette mode (inferior view: See through the vagina) reveals a central hyper-vascular tumor within the peripheral vascular-ring appearance of the cervix (arrows)

as those of malignant lymphoma of the cervix. There are several histologic types of malignant lymphoma.<sup>2</sup> Therefore, it is unknown whether the vascular pattern in the present case fits all types of lymphoma of the uterus. However, this pattern may be characteristic and new features of large cell B lymphoma of the uterine cervix. On the contrary, new features of advanced cervical cancer were a central hypervascular tumor within the peripheral vascular-ring appearance of the cervix. To the best of our knowledge, there has been no report on typical 3D power Doppler features of advanced cervical cancer. Therefore, these findings may be very unique and interesting to understand the characteristics and growth of cervical cancer. These results suggest that this technique may provide useful information on the diagnosis of malignant tumors of the uterine cervix. This is the first step toward using HDliveFlow with the HDlive silhouette mode for the differentiation of malignant tumors of the uterine cervix. However, the data and interpretation should be considered with some degree of caution because of the small number of subjects studied. Further studies involving a larger sample size are needed to confirm the usefulness of this technique for the differentiation of malignant tumors of the uterine cervix.

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