

# HDlive Flow Silhouette Mode for Assessment of Tumor Vascularity in Advanced Cervical Cancer

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## ABSTRACT

**Objective:** To present our experience in assessing tumor vascularity in advanced cervical cancer using the HDlive flow silhouette mode.

**Materials and methods:** Thirteen advanced cervical cancer patients (11 squamous cell carcinoma (SCC) patients and 2 gastric-type mucinous carcinoma (GAS) patients) were studied using the HDlive flow silhouette mode. Tumor vascularity was assessed using the subjective grading system (grade I, minimal blood flow pattern; grade II, moderate blood flow pattern; and grade III, abundant blood flow pattern).

**Results:** The number of patients with grade I was 0, that of grade II was 4 (36.4%), and that of grade III was 7 (63.6%) in the SCC group, whereas that of grade I was 2 (100%) in the GAS group ( $p = 0.0128$ ).

**Conclusion:** Tumor vascularity may differ between SCC and GAS advanced cervical cancers. A grading system using the HDlive flow silhouette mode may provide useful, additional information on the assessment of tumor vascularity in the treatment effect on advanced cervical cancers. Further studies involving a larger sample size are needed to confirm the validity of this grading system using the HDlive flow silhouette mode for the assessment of tumor vascularity in advanced cervical cancer patients.

**Keywords:** Advanced cervical cancer, Gastric-type mucinous carcinoma, HDlive flow silhouette mode, Squamous cell carcinoma, Tumor vascularity. *Donald School Journal of Ultrasound in Obstetrics and Gynecology* (2019): 10.5005/jp-journals-10009-1597

## INTRODUCTION

There have been several studies on two-dimensional (2D) and three-dimensional (3D) color/power Doppler ultrasound evaluations of tumor vascularity in advanced cervical cancer patients.<sup>1–6</sup> However, these results were inconsistent except for one factor: the histologic type. All studies suggested that tumor vascularity was not correlated with histologic characteristics of cervical cancer.

There have been several reports on the use of the HDlive flow silhouette mode for the diagnosis of fetal heart anomalies<sup>7,8</sup> and gynecologic disorders.<sup>9–11</sup> The unique advantages of this technique are that it can differentiate overlapping blood vessels and help understand the spatial relationships among blood vessels. To the best of our knowledge, there has been no report on the HDlive flow silhouette mode for assessing tumor vascularity in advanced cervical cancer. The aim of the present study was to present our experience in assessing the difference of tumor vascularity in advanced cervical cancer patients with different histologic types using this technique.

## MATERIALS AND METHODS

Thirteen women with advanced cervical cancer (one each of cervical cancer stage IIA, three of stage IIB, four of stage IIIB, one of stage IVA, and four of stage IVB) were studied using the HDlive flow silhouette mode (Voluson E10, GE Healthcare Japan, Tokyo, Japan) with a mechanical transvaginal 3.7–17.5 MHz transducer (Table 1). The patients were staged according to International Federation of Gynecology and Obstetrics guidelines.<sup>12</sup> Eleven patients had squamous cell carcinoma (SCC), and two had GAS. This study was approved by the Kagawa University Graduate School of Medicine Ethics Committee, and the standardized written informed consent was obtained from all women.

Initially, 2D sonography and color/power Doppler were used to examine the uterus. Then, on changing to 3D color/power Doppler,

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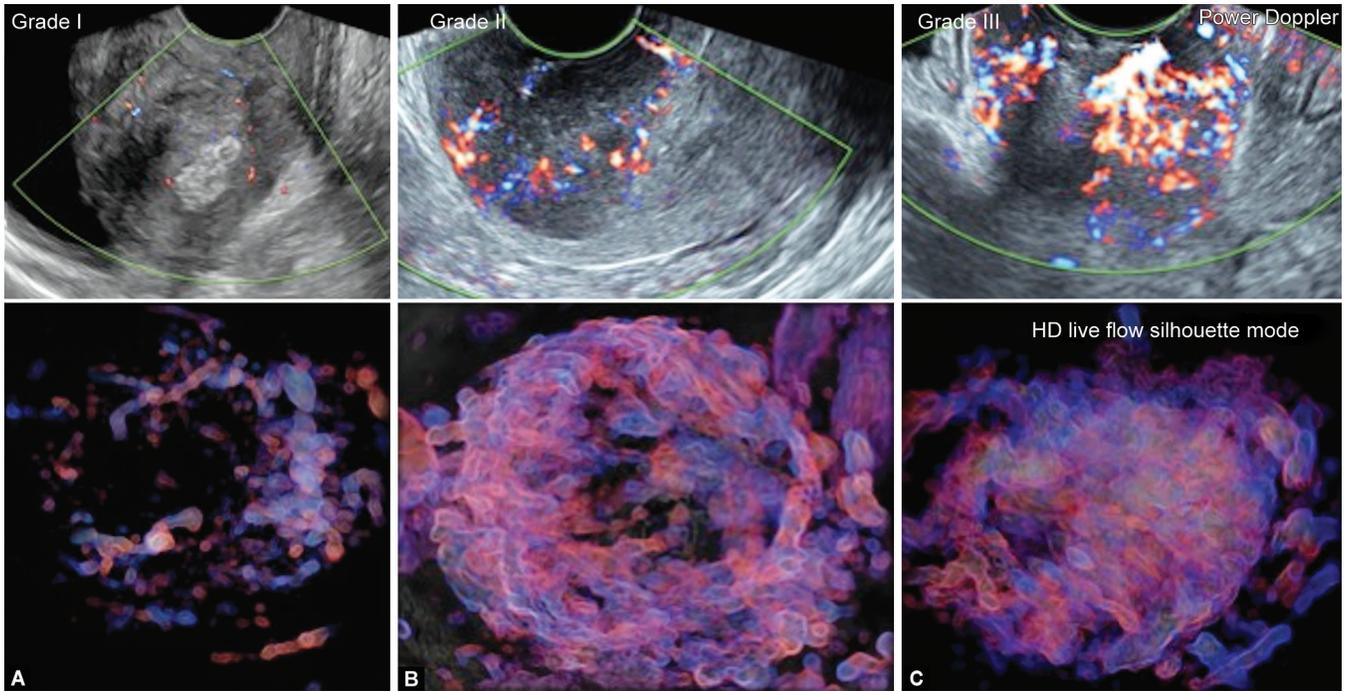
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scanning of the region of interest was performed and the resulting data were stored on the hard drive of the ultrasound device for future analysis. A representative vascular tree volume of the uterine cervix was generated using the HDlive flow silhouette mode. When blood velocity exceeded a threshold, dependent on the pulse repetition frequency (PRF) and high-pass filter of the device, the signal was detected. By setting the PRF as 0.9 kHz and wall motion filter as “low,” sensitivity was maximized. The 3D volume box was placed over the uterine cervix at 120° (fixed angle). Volume acquisition was performed in a period of 16 seconds or less. All volume data were analyzed, and we extracted optimal images for subsequent analysis. The HDlive flow silhouette mode was used for 3D reconstruction. One examiner (TH) conducted all HDlive flow silhouette mode examinations.

Tumor vascularity was assessed using the subjective grading system (grade I, minimal blood flow pattern; grade II, moderate blood flow pattern; and grade III, abundant blood flow pattern) (Fig. 1). The HDlive flow silhouette mode image for each patient was assigned to grades I, II, or III.

The IBM SPSS statistical software version 22 for Windows (IBM SPSS Inc., Chicago, IL, USA) was used in all cases. The amount of



**Figs 1A to C:** Grading system of tumor vascularity using the HDlive flow silhouette mode in advanced cervical cancer (CC) patients. (A) Grade I, minimal blood flow pattern (CC stage IVB, gastric-type mucinous carcinoma); (B) Grade II, moderate blood flow pattern (CC stage IIB, squamous cell carcinoma); (C) Grade III, abundant blood flow pattern (CC IIIIB, squamous cell carcinoma). Power Doppler findings are also shown in each grading as a reference on upper images

**Table 1:** Clinical characteristics of subjects

Patient	Age (year)	Stage	Size (mm)	Histology	Vascularity grade
1	42	IIB	35 × 35	SCC	III
2	87	IIB	29 × 19	SCC	II
3	60	IIB	65 × 30	SCC	II
4	43	IIB	46 × 30	SCC	II
5	51	IIIB	65 × 25	SCC	III
6	63	IIIB	48 × 34	SCC	III
7	55	IIIB	42 × 24	GAS	I
8	67	IIIB	60 × 54	SCC	III
9	50	IVA	54 × 47	SCC	III
10	52	IVB	73 × 52	SCC	III
11	45	IVB	56 × 42	SCC	III
12	73	IVB	45 × 26	GAS	I
13	66	IVB	52 × 41	SCC	II

GAS, gastric-type mucinous carcinoma; vascularity grade, grading of tumor vascularity using HDlive flow silhouette mode; SCC, squamous cell carcinoma

tumor vascularity between SCC and GMC groups was compared using  $\chi^2$  analysis with a contingency table (3 × 2). A value of  $p < 0.05$  was considered significant.

**RESULTS**

The average age of patients was 58 ± 13.1 y.o. (mean ± SD). The tumor size in each patient is shown in Table 1. The number of patients with grade I was 2 (15.4%), that of grade II was 4 (30.8%), and that of grade III was 7 (53.8%) (Table 1).

**Table 2:** Subjective assessment of tumor vascularity using HDlive flow silhouette mode in advanced cervical cancer patients

Histologic type	n	Tumor vascularity (%)			Significance
		Grade I	Grade II	Grade III	
SCC	11	0	4 (36.4)	7 (63.6)	$p = 0.0128$
GAS	2	2 (100)	0	0	

GAS, gastric-type mucinous carcinoma; SCC, squamous cell carcinoma

The number of patients with grade I was 0, that of grade II was 4 (36.4%), and that of grade III was 7 (63.6%) in the SCC group, whereas that of grade I was 2 (100%) in the GAS group ( $p = 0.0128$ ) (Table 2).

**DISCUSSION**

Alcazar et al.<sup>3</sup> reported that subjective impressions of the amount of flow using 2D color Doppler was correlated with some tumor features in cervical cancers. However, the whole-view assessment of tumor vascularity in advanced cervical cancer patients was difficult because of the 2D character of conventional color/power Doppler. Tanaka et al.<sup>13</sup> found that a 3D power Doppler (HDlive flow) frontal view of the cervix, like a colposcopic view of the cervix seen through the vagina, was the most appropriate, unique image to assess the tumor vascularity of advanced cervical cancer patients. However, the complexity and crowding of tumor vessels still could not be evaluated even if using HDlive flow. In the present study, the HDlive flow silhouette mode could clearly show the tumor vascularity of advanced cervical cancer patients because this technique can differentiate overlapping blood vessels and help understand the spatial relationships among blood vessels. Consequently, a new grading system of tumor vascularity using the HDlive flow silhouette mode in advanced cervical cancer patients could be

devised. Further studies involving a larger sample size are needed to confirm the validity of this grading system using the HDlive flow silhouette mode for the assessment of tumor vascularity in advanced cervical cancer patients.

Gastric-type mucinous carcinoma of the uterine cervix is a rare variant of mucinous carcinoma of the uterine cervix associated with aggressive clinical behavior, chemoresistance, and poorer outcomes compared with usual-type endocervical carcinoma.<sup>14–17</sup> In the present study, GAS showed a poorly vascularized mass, whereas SCC demonstrated moderate to abundant blood flow in the mass. These results suggest that the poor vascularity is one of the clinicopathological features of GAS. However, these vascular patterns in the present study should be considered with some degree of caution because of the small number of patients studied. Further studies involving a larger sample size, especially GAS and usual-type endocervical carcinoma patients, are needed to ascertain the tumor vascularity in advanced cervical cancer patients.

## AUTHORS' CONTRIBUTIONS

All the authors take responsibility for the paper as published. Tamaki Tanaka: protocol/project development, data collection, and manuscript editing. Kenji Kanenishi: protocol/project development and manuscript editing. Tomoya Yamashita: data collection and manuscript editing. Nobuhiro Mori: data collection, statistical analysis, and manuscript editing. Toshiyuki Hata: protocol/project development, data collection/analysis, and manuscript writing.

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