

# **Vascularity index as a novel parameter for the in vivo assessment of angiogenesis in patients with cervical carcinoma**

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摘要

**BACKGROUND:** The importance of angiogenesis now is well recognized. Conventionally, tumor angiogenesis is assessed by determination of microvessel density (MVD) in the surgical specimen. This study examines tumor angiogenesis using power Doppler ultrasound and a quantitative image processing system. The authors hope to develop an in vivo and noninvasive method for quantitating tumor angiogenesis. **METHODS:** Thirty-five patients with FIGO Stage IB-IIA cervical carcinoma exhibiting visible cervical tumors by transvaginal ultrasound were included in this study. All patients underwent radical abdominal hysterectomy and pelvic lymph node dissection. Transvaginal power Doppler ultrasound was performed before surgery to search for blood flow signals from the tumor. The intratumoral vascularity index (VI) and resistance index (RI) were calculated. The VI was defined as the number of colored pixels divided by the number of total pixels in the defined tumor section. Maximal VI and minimal RI of a certain tumor were used for analysis. Clinical and pathologic data also were recorded. The MVD of the excised tumor was assessed immunohistochemically using a monoclonal antibody against CD34. **RESULTS:** Significantly higher VI values were noted in Stage II tumors compared with Stage I tumors (19.01±10.90% vs. 9.09±6.59%;  $P = 0.008$ ), tumors invading ±50% of the cervical stroma compared with tumors invading < 50% of the cervical stroma (13.20±8.20% vs. 5.72±5.00%;  $P = 0.003$ ), tumors with lymphovascular emboli compared with tumors without lymphovascular emboli (17.28±8.26% vs. 6.98 ± 5.09%;  $P = 0.001$ ), and tumors with pelvic lymph node metastases compared with tumors without pelvic lymph node metastases (26.16±7.88% vs. 8.00±4.95%;  $P = 0.021$ ). None of the variables mentioned earlier showed a significant difference in terms of the RI values. No correlation was noted between intratumoral RI and VI in respective tumors ( $P = 0.53$ ). Analysis of VI revealed linear regression with regard to tumor size ( $P < 0.001$ , correlation coefficient [ $r$ ] = 0.586) and depth of stromal invasion ( $P = 0.002$ ,  $r = 0.497$ ). In addition,

the MVD exhibited a linear relation with VI ( $P = 0.006$ ,  $r = 0.454$ ), tumor size ( $P = 0.005$ ,  $r = 0.465$ ), and depth of stromal invasion ( $P = 0.009$ ,  $r = 0.436$ ) using simple regression analysis. No correlation could be found between MVD and RI. CONCLUSIONS: In cervical carcinoma, intratumoral VI assessment by power Doppler ultrasound and quantitative image processing system showed better correlation with tumor stage, tumor size, and pathologic findings including depth of stromal invasion, lymphovascular emboli, and pelvic lymph node metastases than intratumoral RI. The in vivo indicator of angiogenic activity (VI) is well correlated with the conventional indicator of tumor angiogenic activity (MVD). Thus, VI could be a useful parameter for the in vivo assessment of global tumor angiogenesis