

# 가 VX-2 :

1

: 가 VX-2 ,  
 : VX-2 1cc 2 18-guage  
 13 가 2 (group A, n=5) , 2  
 4 (group B, n=8) ,  
 extremity coil T2-  
 (signal to noise ratio, SNR)  
 : Group A, B (n=13) 2 T2-  
 3-10 mm( 6.5  
 mm) . 13 3 (23%) (peritoneal nodules)  
 , 1.5-1.8×3.0 cm , 3 (23%)  
 0.6-1.5×1.3-1.5 cm . Group B , 4 (100%)  
 가 5-14 mm( 7.6 mm) 8  
 6 (75%) 1.3-3.0×1.5-6.0 cm .  
 T2- SNR , 가 ,  
 SNR , (n=13)  
 가 , (viable tumor cell)가 .  
 : VX-2 가 ,

(magnetic resonance imaging: MRI)

가 VX-2

MRI

(1-3).

3-3.5 kg

가 (New Zealand White

Rabbit) 13

2002

, 18-

2004 5 15

2004 11 5

guage

VX-2

1 cc VX-2  
6-0 Dexon Glue

0.6 - 1.5 × 1.3 - 1.5 cm (Table 1).

4 8 (100%)

가 (Fig. 1A) 5 - 14

1.5 - T GE Signa (GE Medical Systems, Milwaukee, U.S.A.), extremity coil

T2- (TR/TE : 11200.8 - 14400.5/101.5 msec, FA: 90, FOV: 280 mm, section thickness: 5 mm)

2 (group A, n=5) 2 4  
(group B, n=8) 가

(signal - to - noise ratio; SNR)  
1 × 1 × 1 mm ROI (region of

interest)

2

SNR

2

10

2 0.8 - 1.2 mm ( 1.0  
mm) Group A B 2

T2 -

10 mm ( 4.5 mm) 13 3 (23%)

(peritoneal nodules)

1.5 - 1.8 × 3.0 cm . 3 (23%)

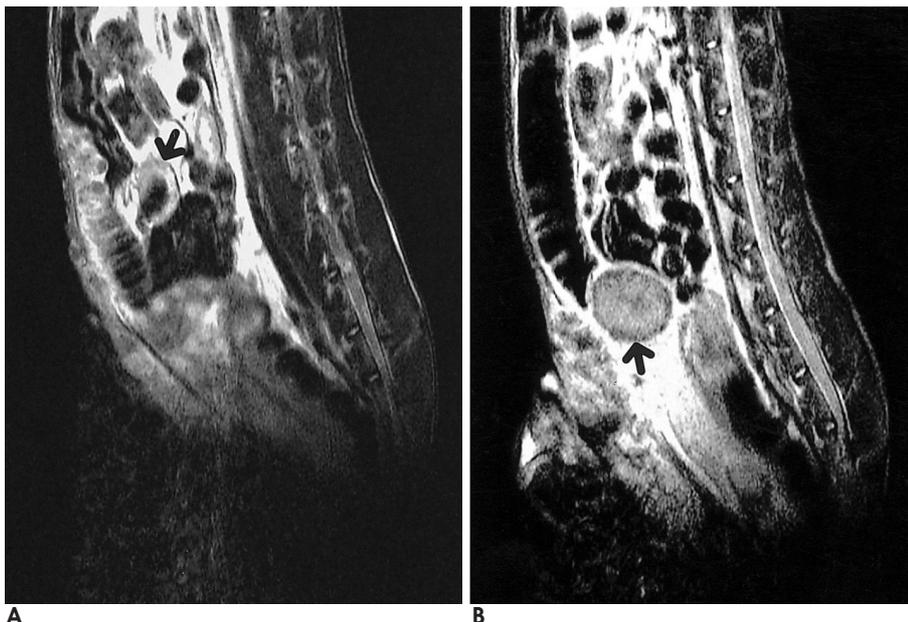
**Table 1.** Wall Mass (or Peritoneal Nodules) and Wall Thickness of Uterine Horn, 2 Weeks after Inoculation (Group A)

Rabbit	Mass or peritoneal nodules (cm)	Wall thickness (mm) of uterine horn
1	none	4
2	1.5 × 3	10
3	2 × 3	5
4	none	4
5	1.8 × 3.0	3
6	none	3
7*	0.6 × 1.3	5
8	none	5
9*	1.5 × 1.5	3
10	none	3
11*	1 × 1.3	7
12	none	4
13	none	3

\* Rabbits demonstrated uterine masses.

**Table 2.** Wall Mass (or Peritoneal Nodules) and Wall Thickness of Uterine Horn, 4 Weeks after Inoculation (Group B)

Rabbit	Wall mass (cm)	Peritoneal nodules (cm)	Wall thickness (mm) of uterine horn
6	3 × 4.5	0.6 × 0.6	5
7	3 × 5	none	7
8	2 × 3	2 × 3	7
9	3 × 3 × 6	none	14
10	none	1 × 1	8
11	1.3 × 1.5	none	10
12	2 × 5	2 × 2	5
13	none	1.5 × 3	5



**Fig. 1.** Two different types of the uterine VX-II tumors experimentally developed in rabbits.

**A.** T2-weighted MRI showed thickened rabbit uterine horn (arrow).

**B.** T2-weighted MRI demonstrated a mass on rabbit uterine horns (arrow).

A

B

mm ( 7.6 mm) (Table 2). 6/8 (75%)  
 , 1.3 - 3.0 × 1.5 - 6.0 cm (Table 2,  
 Fig. 1B).

T2 - 가  
 SNR , 가  
 . VX - 2 4  
 SNR ,

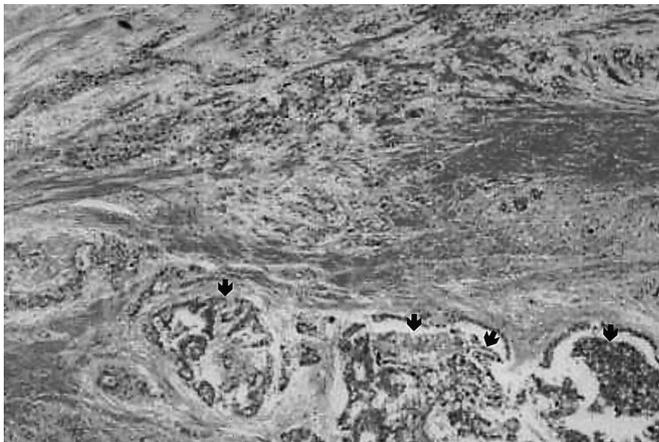
SNR 130 - 200 VX - 2  
 SNR 230 - 392 ( 318 ± 38)  
 SNR 291 - 463 (360 ± 52)  
 (Table 3).  
 가 ,  
 (Fig. 2).

**Table 3.** Signal Intensity of Thickened Uterine Horns and Masses Compared with the Signal Intensity of Normal Uterine Horns of Rabbit Uterus, 4 Weeks after Inoculation

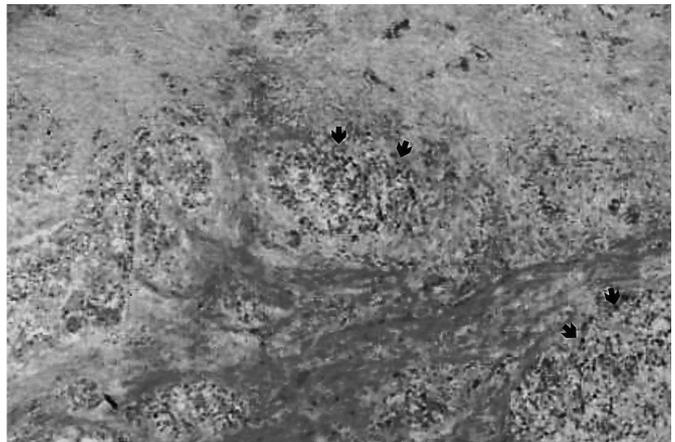
Rabbit	SI of thickened horns	SI of mass or peritoneal nodules	SI of normal horns
6	392	291	
7	302	463	
8	230	370	
9	372	261	
10	312	453	
11	347	361	
12	295	377	
13	294	331	
Mean	318 ± 38	360 ± 52	160 ± 30

SI: Signal Intensity

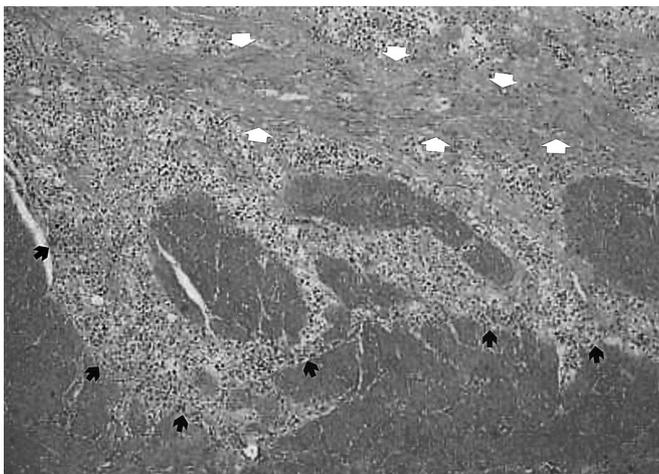
VX - 2  
 . VX -  
 가  
 (sinusoidal)  
 가



A



B



C

**Fig. 2.** Microscopic examinations of VX-II carcinomas of rabbit uterus.

**A.** Microscopic examination of the wall of uterine horns of rabbit shows fibrotic tissues and cancerous cells (arrows) (H & E stain, × 400).

**B.** Microscopic examination of the center of the rabbit uterine tumors shows fibrotic tissues and some sparse cancerous cells with massive apoptosis (arrows) (H & E stain, × 400).

**C.** Microscopic examination of the periphery of rabbit uterine tumor shows fibrotic tissues (white arrows) and viable cancerous cells (black arrows) (H & E stain, × 400).

Gd-DTPA

가 가

(4).

가 , 가 VX-2

(5-8).

VX-2 (9), (10), (11), (12)

13 가 VX-2

13 (Table 1, 2), 6 (46%)

가 VX-2

T2- 가 가 가

가 VX-2 가

(5, 7, 13, 14).

가 (5, 7, 13, 14),

가

VX-2 Sundaram (15) T2-

(9)

T2- 가

T2- 가

T2

1. Worthington JL, Balfe DM, Lee JK, Gersell DJ, Heiken JP, Ling D, et al. Uterine neoplasms: MR imaging. *Radiology* 1986;159:725-730
2. Sahdev A, Sohaib SA, Jacobs I, Shepherd JH, Oram DH, Reznik RH. MR imaging of uterine sarcomas. *AJR Am J Roentgenol* 2001;177:1307-1311
3. Moon KL Jr, Davis PL, Kaufman L, Crooks LE, Sheldon PE, Miller T, et al. Nuclear magnetic resonance imaging of a fibrosarcoma tumor implanted in the rat. *Radiology* 1983;148:177-181
4. VX2 1994
5. Hough A Jr, Seyberth H, Oates J, Hartmann W. Changes in bone and bone marrow of rabbits bearing the VX-2 carcinoma. A comparison of local and distant effects. *Am J pathol* 1977;87:537-552
6. Burgener FA. Peripheral hepatic artery embolization in rabbits with VX-2 carcinomas of the liver. *Cancer* 1980;46:56-63
7. Young DM, Fioravanti JL, Prieur DJ, Ward JM. Hypercalcemic VX-2 carcinoma in rabbits: a clinicopathologic study. *Lab Invest* 1976;35:30-46
8. Kobayashi N, Allen N, Clendenon NR, Ko LW. An improved rat brain-tumor model. *J Neurosurg* 1980;53:808-815
9. 가 VX-2 carcinoma 1990;26:230-241
10. 가 VX-2 1994;30:521-529
11. Yancey JM, Ackerman N, Kaude JV, Googe RE, Fitzsimmons JR, Scott KN, et al. Gadolinium-DTPA enhancement of VX-2 carcinoma of the rabbit kidney on T1 weighted magnetic resonance images. *Acta Radiol* 1987;28:470-482
12. 가 : 가 VX-2 carcinoma 1993;29:507-515
13. Young DM, Ward JM, Prieur DJ. Hypercalcemia of malignancy. Animal model: VX-2 carcinoma of rabbits. *Am J Pathol* 1978;93:619-622
14. Revel D, Brasch RC, Paajancen H, Rosenau W, Grodd W, Engelstad B, et al. Gd-DTPA contrast enhancement and tissue differentiation in MR imaging of experimental breast carcinoma. *Radiology* 1986;158:319-323
15. Sundaram M, McGuire MH, Herbold DR, Beshany SE, Fletcher JW. High signal intensity soft tissue masses on T1 weighted pulsing sequences. *Skeletal Radiol* 1987;16:30-36

## Development of VX-II Carcinoma Model in Rabbit Uterus: Evaluation with MR Imaging and Histopathology<sup>1</sup>

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**Purpose:** To develop a VX-II carcinoma model in the rabbit uterus and to describe the MR imaging findings of an experimentally induced VX-II uterine carcinoma along with the histopathologic findings.

**Materials and Methods:** 13 New Zealand rabbits were included in this study. Two pieces of tissue suspension ( $1 \text{ mm}^3 \times 2$ ) of VX-II carcinoma were loaded in an 18 gauge disposable needle and the tissue embedded in the wall of each horn of the rabbits' uterus. We obtained the MR images at 2 weeks in group A ( $n=5$ ), or at 2 and 4 weeks in group B ( $n=8$ ). T2-weighted images were obtained using an extremity coil. On MR imaging, we measured the signal intensity of the tumor and the uterine wall. We also measured the size and shape of the tumor and we compared this with the histopathologic results.

**Results:** On MR images obtained 2 weeks after inoculation, all the rabbit uteruses (group A and B,  $n=13$ ) show a thick tubular wall, and the uteruses demonstrated a high signal intensity on T2-weighted images. The thickened uterine walls were measured as 3 - 10 mm (mean: 6.5 mm). Peritoneal nodules were observed in 3/13 rabbits (23%), the nodules measured 1.5 - 1.8  $\times$  3.0 cm; uterine masses were observed in 3/13 rabbits (23%), and they measured 0.6 - 1.5  $\times$  1.3 - 1.5 cm. On MR images obtained 4 weeks after the inoculations (group B,  $n=8$ ), rabbit uteruses that had VX-II carcinoma show thick tubular wall in all cases ( $n=8$ , 100%) and round uterine masses ( $n=6$ , 75%). The thickened uterine walls measured 5 - 14 mm (mean 7.6 mm) and uterine masses measured 1.3 - 3.0  $\times$  1.5 - 6.0 cm. All the rabbit uteruses having VX-II carcinoma showed high signal-to-noise ratios along the thickened uterine walls or masses on T2WI. On the histopathologic exam after sacrificing the rabbit, a few viable tumor cells were found because of necrosis in the inner portion of the uterine tumors, and abundant viable tumor cells were found at the periphery of the uterine tumors.

**Conclusion:** We can develop an animal model with uterine tumor in rabbit uterus using VX-II carcinoma. Experimentally induced VX-II carcinomas in rabbit uterus demonstrated central necrosis, and MR imagings of experimentally induced uterine VX-II carcinomas were well correlated with the histopathology.

**Index words :** Uterine neoplasms, MR  
Magnetic resonance (MR)

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