Holmium-chitosan
간암의 정간동백 $^{166}$Holmium-chitosan 복합체 주입 치료

지도 김 명 진 교수

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166Holmium-chitosan
Holmium-chitosan treatment resulted in 166 cases of 

CT evidence of complete resolution, with a mean size of 5.1 ± 2.3 cm. 

In 166 Holmium-chitosan cases, the mean tumor size was 6 cm. 

CT evidence of complete resolution was seen in 6 cases, with a mean size of 0.4 ± 2.1 cm. 

114 cases showed 72% (63%) resolution, with 81% (63%) in Child A and B. 

In 114 cases, the mean tumor size was 114 ± 72 cm. 

Child A, B, and C had 93%, 95%, and 98% resolution, respectively.
À²À» Åë°èÇÐÀûÀ¸·Î ±¸ÇÒ¼ö ¾ø¾ú´Ù

°á·ÐÀûÀ¸·Î, °£µ¿¸ÆÀ» ÅëÇÑ 166Holmium-chitosan º¹ÇÕü ÁÖÀÔÀº µÎ°³ ÀÌÇÏ
ÀǼ·½Äµ¿¸ÆÀ» °¡Áö¸ç µ¿Á¤¸Æ ¶Ç´Â µ¿¹®¸Æ ´Ü¶ôÀ̳ª ¹®¸ÆÇ÷ÀüÁõÀÌ ¾ø´Â °£¼¼Æ÷
¾Ï Ä¡·á¿¡ È¿°úÀûÀ̸ç, ÇÕº´ÁõÀÇ ºóµµ¿Í Á¤µµ´Â ´Ù¸¥ ºñ¼ö¼úÀû Ä¡·á¹ý°ú ºñ½Á
ÇÏ¿©, °£¼¼Æ÷¾ÏÀÇ ºñ¼ö¼úÀû Ä¡·áÀÇ ÇÑ ¾ç½ÄÀ¸·Î ÀÓ»ó¿¡¼­ ÀÌ¿ëÇÒ ¼ö ÀÖÀ» °Í
À¸·Î »ý°¢ÇÑ´Ù.

ÇٽɵǴ ¸» : °£¼¼Æ÷¾Ï, 166Holmium- chitosan º¹ÇÕü, Àü»êÈ­ ´ÜÃþÃÔ¿µ, Ç÷°ü
ÃÔ¿µ¼ú, Á¾¾ç±«»ç
$^{166}$Holmium-chitosan
131Iodine, 90Ytrrium are now in clinical use. 10-13. 131Iodine-lipiodol is used to deliver radiation to the tumor.

82Iodine-

90Ytrrium emits 64% of its energy as 18.6 MeV photons, 32% as 2.2 MeV photons. 10-13.

88Ytrrium emits 51% of its energy as 18.6 MeV photons, 49% as 2.2 MeV photons. 10-13.

166Holmium emits 26.83% of its energy as 1.83 MeV photons, 95% as lower energy photons. 15.
166Holmium-chitosan [15,16] was used. Glucosamine [17] and pH [18] were also studied.

166Holmium-chitosan (Milican R, µ¿È­¾àǰ, òï, Çѱ¹) was used. The pH was adjusted to

166Holmium-chitosan [19] was used. The pH was adjusted to

166Holmium-chitosan [16] was used. The pH was adjusted to

...
166holmium-chitosan 63% 63%

20.

166holmium-chitosan

5cm

pH 4 (pH 7)

166holmium-chitosan
1. 

1999 2 2001 7 166Holmium-chitosan, 118, 1 4, 114, 129 166Holmium-chitosan 118, 1 4, 114, 129 166Holmium-chitosan, 10cm 166Holmium-chitosan, 56.7 20-84
Child class A 90 (79%), Class B 20 (18%), Class C 4 (4%).

114° °£°æÈ­°¡ 129°³ÀÇ °£¼¼Æ÷¾ÏÀÇ ÀÖ¾úÀ¸¸ç °£°æÈ­ Æò±Õ 166Holmium-chitosan ÁÖ»ç¿ë ÀÖÀÔÇÏ¿´´Ù Æò±Õ 17°³¿ùÀ̾ú´Ù.

°£¼¼Æ÷¾ÏÀÇ Áø´ÜÀº °£¿°, °£°æÈ­°¡ Àִ ȯÀÚ¿¡¼­ òëÇØ °£µ¿¸ÆÀ» ÅëÇØ 166Holmium-chitosan Æò±Õ 129°³ÀÇ °£¼¼Æ÷¾Ï¿¡ ÀÖÀÔÇÏ¿´´Ù.

2. 166Holmium-chitosan Æò±Õ 17°³¿ùÀ̾ú´Ù

166Holmium nitrate pentahydrate (165- Ho(NO₃)₃5H₂O) ÁÖ»ç¿ë Áõ·ù¼ö¿¡ ³ì¿© ¿ë¾× 1ml·Î ¿ÀÀü¿¡ ¹Ì¼¼Ä§ÈíÀλý°Ë¼úÀÇ 0.000 42°³¿ùÀ̾ú´Ù 17.6°³¿ùÀ̾ú´Ù.
(1-4)-linked, 2 amino deoxy-β-D-glucopyranose, 300,000-500,000.

Milican, Milican, Milican (Milican, Milican, Milican, Milican).

\( ^{166} \text{Holmium-chitosan} \) 1ml 20mCi.

3. \( ^{166} \text{Holmium-chitosan} \) 1cm 20mCi 3Fr.


166holmium

4. 

1. 

6. 

CT

(tumor necrosis: TN)

(tumor regression: TR)

(therapeutic effect: TE)

CR

CT

2.
1. **Therapeutic effect, TE**

<table>
<thead>
<tr>
<th></th>
<th>Tumor Necrosis (TN)</th>
<th>Tumor Regression (TR)</th>
<th>Therapeutic Effect (TE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0%</td>
<td>0%, progression</td>
<td>any TN, TR 1</td>
</tr>
<tr>
<td>2</td>
<td>0%&lt;TN≤25%</td>
<td>0%&lt;TR≤25%</td>
<td>TN 2 or TR 2</td>
</tr>
<tr>
<td>3</td>
<td>25%&lt;TN≤50%</td>
<td>25%&lt;TR≤50%</td>
<td>TN 3 or TR 3</td>
</tr>
<tr>
<td>4</td>
<td>50%&lt;TN&lt;100%</td>
<td>50%&lt;TR&lt;100%</td>
<td>TN 4 or TR 4</td>
</tr>
<tr>
<td>5</td>
<td>TN : 100%</td>
<td>TR : 100%</td>
<td>TN or TR 5</td>
</tr>
</tbody>
</table>

**TN**: tumor necrosis

**TR**: tumor regression

**TE**: therapeutic effect
(disappearance; D), (regression; R), (no change; N), (advance; A)

2.

<table>
<thead>
<tr>
<th>Response</th>
<th>TE</th>
<th>Change</th>
<th>CR</th>
<th>TE5</th>
<th>D</th>
<th>no</th>
</tr>
</thead>
<tbody>
<tr>
<td>PR</td>
<td>TE4</td>
<td>R</td>
<td>PR</td>
<td>TE4</td>
<td>R</td>
<td>no</td>
</tr>
<tr>
<td>MR</td>
<td>TE3</td>
<td>R</td>
<td>MR</td>
<td>TE3</td>
<td>R</td>
<td>no</td>
</tr>
<tr>
<td>NC</td>
<td>TE2</td>
<td>N</td>
<td>NC</td>
<td>TE2</td>
<td>N</td>
<td>no</td>
</tr>
<tr>
<td>PD</td>
<td>TE1</td>
<td>A</td>
<td>PD</td>
<td>TE1</td>
<td>A</td>
<td></td>
</tr>
</tbody>
</table>

CR, complete response; PR, partial response; MR, minor response; NC, no change; PD, progressive disease

D, disappearance; R, regression; N, no change; A, advance
ホリウム-チトサン 

2\(^{166}\)ホリウム-チトサン 

TN 5\(^{166}\)ホリウム-チトサン

CR\(^{166}\)ホリウム-チトサン

1\(^{166}\)ホリウム-チトサン

4,000mL/μL

4,000mL/μL

2\(^{166}\)ホリウム-チトサン

100,000mL/μL

2\(^{166}\)ホリウム-チトサン

(3)
### 3. 

<table>
<thead>
<tr>
<th></th>
<th>G0</th>
<th>G1</th>
<th>G2</th>
<th>G3</th>
<th>G4</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC (1,000/µL)</td>
<td>&gt;4</td>
<td>3-3.9</td>
<td>2-2.9</td>
<td>1-1.9</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Plt (10,000/µL)</td>
<td>&gt;10</td>
<td>7.5-9.9</td>
<td>5-7.4</td>
<td>2.5-4.9</td>
<td>&lt;2.5</td>
</tr>
</tbody>
</table>

5. 

- SPSS 11.0
- Kaplan-Meier actuarial method

III. 

- 72% (63%) 81 (63%) 64% 11% 6% 
- TE 5% CR 72%

166Holmium-chitosan

- TE 5%, CR 72% (Figure 2).
4. **Holmium-chitosan**

<table>
<thead>
<tr>
<th>Class A</th>
<th>Class B</th>
<th>Class C</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>(n=90)</td>
<td>(n=20)</td>
<td>(n=4)</td>
<td>(n=114)</td>
</tr>
</tbody>
</table>

- **< 3cm (n=26)**
  - Class A: 17
  - Class B: 5
  - Class C: 0
  - Total: 22 (79%)

- **> 3cm (n=88)**
  - Class A: 42
  - Class B: 8
  - Total: 50 (56%)

**Total**: 59 (82%) 13 (18%)
Figure 1. $^{166}$Holmium-chitosan microspheres CR® 3cm 64mCi

a)  

b)  

c)  

d)  

e)  

a). $^{166}$Holmium-chitosan microspheres CR® CT® 3cm 64mCi.

b). 1° CT®.

c). $^{166}$Holmium-chitosan microspheres CT®.

d and e). 1° CT®.
Figure 2. \( ^{166} \text{Holmium-chitosan} \) CR \( 8.5 \text{cm} \) CR \( 53 \text{cm} \).

a)  

b)  

c)  

d)  

e)  

f)  

g)  

a). \( \text{CT} \)
160mCi $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$.

b). 1$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ 70% $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ 6cm $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

60mCi $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

c). 2$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

d). 1$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ 4.5cm $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

e). 2$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

160mCi $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

f). 1$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ 60mCi $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

g). 2$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ 1$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$ $\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$.

$\epsilon$ $\mu$ $\alpha$ $\beta$ $\gamma$ $\delta$. 
Complete response CR 114 (38%) TE 1 (0%). PD (progressive disease) 16 (38%), NC (no change) 4 (10%), MR (minor remission) 4 (10%), PR (partial remission) 18 (42%) (Figure 3, 4).

Figure 3. Complete response.

1, PD (progressive disease); 2, NC (no change); 3, MR (minor response); 4, PR (partial response)
Figure 4. $^{166}$Holmium-chitosan TE 2µm 25% 2µm 25% 2µm.
d) $^{166}$holmium-chitosan 140mCi 100kCi CT 25% 30% 30%, 30%, 11%, 3%, 4%, 4%, 23% (18%) 2 3 4

(n=3, 3%), (n=3, 3%), (n=12, 11%), (n=4, 4%), (n=1, 1%) 23% (18%) 2 3

(n=4, 4%), (n=2, 2%), (n=1, 1%) (13%) (5).
<table>
<thead>
<tr>
<th>Condition</th>
<th>Child A (n=90)</th>
<th>Child B (n=20)</th>
<th>Child C (n=4)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancytopenia</td>
<td>11</td>
<td>3</td>
<td>1</td>
<td>15 (13%)</td>
</tr>
<tr>
<td>Liver abscess</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2 (2%)</td>
</tr>
<tr>
<td>Hepatic failure</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>Cholecystitis</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

Child Class A: 90 (2%), B: 20 (15%), C: 4 (25%).
Table 6. 

<table>
<thead>
<tr>
<th></th>
<th>Class A (n=90)</th>
<th>Class B (n=20)</th>
<th>Class C (n=4)</th>
<th>Total (n=114)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hepatic failure</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>4 (4%)</td>
</tr>
<tr>
<td>Tumor rupture</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1 (1%)</td>
</tr>
<tr>
<td>Pancytopenia</td>
<td>1</td>
<td></td>
<td></td>
<td>1 (1%)</td>
</tr>
</tbody>
</table>

Child A, B: 95%, 80%. 4

Child C: 3, 4, 7, 27. 1

(Figure 5, 6).
Figure 5. Child A's 10-year cumulative survival.

The graph shows the cumulative survival rate of Child A over time, with the x-axis representing months and the y-axis representing cumulative survival. The 95% confidence interval is indicated by the shaded area.
Figure 6. Child B 100% 10 10 10 10

Cum Survival

Child B 100% 10 10 10 10 80%

IV. 22
Å©±â°¡ 5cm ÀÌ»óÀ¸·Î Å©°Å³ª, ¿©·¯ °³ÀÇ Á¾¾çÀÌ ÀÖ´Â °æ¿ì, °æÇÇÀû õÀÚ°¡ ¾î·Á¿î °æ¿ì¿¡´Â °æ°£µ¿¸Æ È­Çпä¹ýÀ» ÀÌ¿ë ÇÑ´Ù22.

º» ¿¬±¸¿¡¼­ »ç¿ëÇÑ °æ°£µ¿¸Æ 166Holmium-chitosan º¹ÇÕü ÁÖÀÔÀº Á¾¾ç±«»ç¸¦ À¯¹ßÇÏ¿© ÅøºÎÇ÷°üÀÇ ¹ß´ÞÀ» ¾ïÁ¦ÇÒ¼ö ÀÖÀ» °ÍÀ¸·Î »ç·áµÈ¸ç, CRÀ» º¸ÀΠȯÀÚ 72¸íÁß 3¸í(4%)¿¡¼­¸¸ÀÌ º¯¿¬ºÎ¿¡¼­ Àç¹ßÀ» º¸¿´´Ù 42¸í. CRÀ» º¸ÀÌÁö ¾Ê¾Ò´ø °ÍÀº °£¼¼Æ÷¾Ï¿¡ ÁýÀûµÈ Ȧ¹ÅÀÇ ¹æ»ç¼±È¿°ú ¡ ÅëÇÑ 166Holmium-chitosan ÀÇÀ» ÅëÇÑ 166Holmium-chitosan á®º ÀÎÇØ °£¼¼Æ÷¾Ï¿¡ ÁýÀûµÈ Ȧ¹ÅÀÇ ¹æ»ç¼±³óµµ°¡ Àû¾ú±â ¶§¹®À¸·Î »ý°¢µÈ´Ù.
(11%), (3%), (3%), (1%)  12, 19
(20%)  10%
(2%), (1%), (4%)  2.4%
(16%)  2 (2%)
(2%)  1 (1%)  Bismuth 22
(16%)  10%
(1%)  4%  6-9cm(9, 6, 8, 8cm)
4 (4%)  22
4  2.4%
19
6-9cm(9, 6, 8, 8cm)
166Holmium-chitosan
166Holmium-chitosan 114Å, 15Å, °£µ¿¸ÆÀ» ÅëÇØ Åõ¿©½Ã ¹üÇ÷±¸ ÀÇ ½É°¢ÇÑ °¨¼ÒÁõÀÌ »ý±æ ¼ö ÀÖ´Ù.

º» ¿¬±¸¿¡¼­´Â 114¸íÀÇ ȯÀÚÁß 15¸íÀÇ È¯ÀÚ¿¡¼­ ¹éÇ÷±¸¿Í Ç÷¼ÒÆÇ°¨¼ÒÁõÀÌ ¹ß»ýÇÏ¿´°í ¸ðµÎ 3-4ÁÖ »ç ÀÌ¿¡ ¹ß»ýÇÏ¿´´Ù.

ÀÌÁß 1¸íÀÌ °ñ¼ö ÀúÇÏ·Î ÀÎÇÑ ¹éÇ÷±¸¿Í Ç÷¼ÒÆÇ°¨¼ÒÁõÀ¸·Î ÀÎ ÇØ »ç¸ÁÇÏ¿´´Ù.

°ñ¼ö ÀúÇÏ´Â ¹æ»ç¼±ÀÇ Àü½ÅÁ¶»ç ¹× ´Ù¸¥ ¹æ»ç¼º µ¿À§¿ø¼Ò¸¦ ÀÌ ¿ëÇÑ Ä¡·á¿¡¼­µµ ³ªÅ¸³ª´Â Çö»óÀÌ´Ù.

±èµî19ÀÇ ¼º°ß¿¡¼­ÀÇ ½ÇÇè¿¡¼­ ¹éÇ÷±¸¿Í Ç÷¼ÒÆÇ ¼öÄ¡´Â ¾àÁ¦ Åõ¿©ÈÄ 5-10ÀϺÎÅÍ °¨¼ÒÇÏ´Ù°¡ 21Àϰ °¡Àå °¨¼ÒÇÏ ¿´À¸¸ç ¼­¼­È÷ ȸº¹µÇ¾î 12ÁÖ¿¡´Â Á¤»óÀ¸·Î ȯ¿øµÇ¾ú´Ù°í º¸°íÇÏ¿´´Ù.

½Ã±âº° ·Î ½ÃÇàÇÑ °ñ¼ö°Ë»ç»ó °ñ¼öÀúÇÏ´Â °¡¿ªÀûÀÎ ¹ÝÀÀÀ̰í, µ¿¹®¸Æ, µ¿Á¤¸Æ ´Ü¶ôÀÌ ¾ø¾îµµ Åõ¿©ÇÑ ¾àÁ¦°¡ °ñ¼ö·Î ¼·ÃëµÇ¾î ÃÊ·¡µÇ´Â °á°ú¶ó°í º¸°íÇÏ¿´´Ù.

¹æ»ç¼± µ¿À§¿ø¼Ò¸¦ ÁÖÀԽà ¹ß»ýÇÒ ¼ö ÀÖ´Â ½É°¢ÇÑ ÇÕº´ÁõÁßÀÇ Çϳª´Â À§Àå°ü°è ÃâÇ÷À» º¸ÀΠȯÀÚ´Â ¾ø´Âµ¥, Á¾¾ç
166Holmium-chitosan was administered with 20mCi, 0.17%, 40mCi, 0.24% and 200mCi in 19. A Foley catheter was used 10 months. 166Holmium-chitosan was administered 93%, Child A 95%, Child B 80%.
1% Bismuth, Bismuth²², 71%, Child A, B, C 71%. 53%, 18%...
1. 72(61%) 81(63%) 6 CT CR

2. 166Holmium- chitosan 1(11%), (3%), (3%), (1%) (18%) . (4%), (2%), (1%), (16%) (19%) (5%) . 3-4 (13%) .

3. 166Holmium- chitosan 93%, Child A 95%, Child B 80%


3. ［49］. 世界健学会誌 1992;35:36-42.


6. Ohto M, Ebara M, Watanabe J, Sugiura N, Shinagawa T, Okuda K. Percutaneous ethanol injection therapy for small Hepatocellular...


11. 완주, 완주, 완주, 완주, 완주, 완주, 완주, 완주. 완주 완주 완주.

   $^{131}$I- Lipiodol 완주 완주 완주 완주 완주 완주.


16. ÀÌ¿¬Èñ, ÀÌÁ¾ÅÂ, À¯Çü½Ä, ¹®¿µ¸í, ±èº´·Î, ¹ÚÂùÀÏ µî¸¶¿ì½º ÇÇÇÏ¿¡ À̽ĽÃ Holmium-chitosanÀÇ È¿°ú ÒëÇѹæ¼±ÀÇÇÐÁö 1998;38:83-91.


20. DW-166HC. 


23. 131I-Lipiodol. 

Abstract

Transarterial $^{166}$Holmium- chitosan complex injectin in hepatocellular carcinoma

Hee Jung Moon

Department of medicine
The Graduate School, Yonsei University

(Directed by Professor Myeong- J in Kim)

There are various methods of non-surgical treatment of the hepatocellular carcinoma(HCC). Among them transarterial chemoembolization(TACE) and percutaneous ethanol injection(PEIT) have been generally used. However in the particular case of HCC, intraarterial injection of radionuclide, $^{90}$Yttrium has been reported. $^{166}$Homium radionuclide has high beta energy($E_{\text{max}}$: 1.84MeV) almost same as $^{90}$Yttrium in terms of physical property, but it contains the important gamma photon(5%), which can be able to make radionuclide imaging under gamma camera. Prior to clinical application in the treatment of HCC, intraarterial injection of $^{166}$Homium- chitosan complex was
experimentally performed.

The purpose of this clinical study was to evaluate the treatment effect, complication, and survival by the intraarterial injection of $^{166}$Hoium-chitosan complex in the non-surgical treatment of HCC.

From February 1999 to July 2001, 129 hepatocellular carcinomas in 114 patients were treated. They were 97 male to 17 female and ranged between 20 to 84 years old (mean: 56.7). The criteria of patient selection by CT and hepatic angiogram were: 1) tumor with the smaller than 10cm in diameter, 2) single nodular tumor with one another daughter nodule supplied by the same artery, 3) no arterio-venous or arterio-portal shunt, 4) tumor with one or two supplying arteries. The mean diameter of tumor was 5.1±2.3cm. The treatment effect was evaluated with CT, angiography and combined with other imaging methods during the period from one to 42 months (mean: 17.6 months).

Complete response (CR) was 73 tumors (63%), partial response (n=18, 16%), minor response (n=4, 4%), no change (n=4, 4%), and progressive
disease (n=16, 14%). The minor complication such as nausea (3%), vomiting (3%), fever (11%), abdominal pain (1%), and the elevation of the serum transaminase levels (4%) occurred in 23 patients (20%). The serious ones were hepatic failure (4%), liver abscess (2%), and acute cholecystitis (1%) in 7 patients and mortality rate was 5.4% within post-treatment 3 months. In terms of survival rate, one year survival was 93% of 114 patients by the Kaplan-Meier method, 95% for child class A and 80% for class B by Child classification.

In conclusion, transarterial \( ^{166} \text{Ho} \)-chitosan complex injection was thought to be very effective in the treatment of nodular and hypervascular HCC, even if there was some limitations for application and the fear of radiation hazard.

Key words: hepatocellular carcinoma, CT, angiography, tumor necrosis