

## Comparison of Results according to the Treatment Method in Maxillary Sinus Carcinoma

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### = Abstract =

**Purpose:** A retrospective analysis was performed to investigate the proper management of maxillary sinus carcinoma.

**Materials and Methods:** Authors analysed 33 patients of squamous cell carcinoma of maxillary sinus treated at Chonnam University Hospital from January 1986 to December 1992. There were 24 men and 9 women with median age of 55 years. According to AJCC TNM system of 1988, a patient of T2, 10 patients of T3 and 22 patients of T4 were available, respectively. Cervical lymph node metastases was observed in 5 patients (N1;4/33, N2b;1/33). Patients were classified as 3 groups according to management method. The first group, named as "FAR" (16 patients), was consisted of preoperative intra-arterial chemotherapy with 5-fluorouracil (5-FU; mean of total dosage; 3078mg) through the superficial temporal artery with concurrent radiation (mean dose delivered; 3433cGy, daily 180-200cGy) and vitamin A (50,000 IU daily), and followed by total maxillectomy and postoperative radiation therapy (mean dose; 2351cGy). The second group, named as "SR" (7 patients), was consisted of total maxillectomy followed by postoperative radiation therapy (mean dose 5920 cGy). The third group, named as "R" (6 patients), was treated with radiation alone (mean dose; 7164cGy). Kaplan-Meier product limit method was used for survival analysis and Mantel-Cox test was performed for significance of survival difference between two groups.

**Results:** Local recurrence free survival rate in the end of 2 year was 100%, 50% and 0% in FAR, SR and R group, respectively. Disease free survival rate in 2 years was 88.9%, 28.6% and 0% in FAR, SR and R group, respectively. Overall survival rate in 2 years was 88.9%, 40% and 50% in FAR, SR and R group, respectively. There were statistically significant difference between FAR and SR or FAR and R group in their local recurrence free, disease free and overall survival rates. But difference of each survival rate between SR and R group was not sig-

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nificant.

**Conclusion:** In this study FAR group revealed better results than SR or R group. In the future prospective randomized study is in need.

**Key Words :** Maxillary sinus carcinoma, Results, Survival

## INTRODUCTION

Maxillary sinus carcinoma is rarely diagnosed in early stage. And it usually presents a locally advanced lesion which invades surrounding structures such as orbits, nasal cavity, oral cavity, ethmoid, sphenoid sinuses and base of skull<sup>1)</sup>. These tumors tend to be localized for long periods, so local control is very important to cure of disease. Consequently surgery and radiation therapy has been an important tool until now. At present there is a controversy in what the optimum treatment method is.

Authors analysed 33 patients of squamous cell carcinoma of maxillary sinus treated at the Chonnam University Hospital through 1986 to 1992 retrospectively. We tried to compare locoregional recurrence free survival, disease free

and overall survival rate according to the treatment method.

## MATERIALS AND METHODS

From January 1986 to December 1992 fifty one patients of maxillary sinus neoplasm were seen at the Department of Therapeutic Radiology, Chonnam University Hospital. They were composed of 41 patients of squamous cell carcinoma and 10 of non-squamous histology. Of 41 patients of squamous cell carcinoma 8 patients who had been interrupted at initial stage of treatment were excluded in this analysis. So finally 33 patients were included to this study (Table 1). The patients who were analyzed in this study had no distant metastases and no prior definitive therapy at admission.

There were 24 men and 9 women (age range; 31-70, Median; 55 years). The most common presenting symptom was tender swelling of involved cheek (23/33) (Table 2). Symptom duration ranged from 1 month to 24 months and median was 3 months. The right maxillary sinus was involved in 18 patients and left was in 15 patients. All the patients were proven histologically as a squamous cell carcinoma. The work-up for staging included physical examination, and ear, nose, throat examination, computerized tomography of paranasal sinus (28/33). All patients were staged according to the American Joint Committee for Cancer Staging System<sup>2)</sup>. Among 33 patients 1 patient was staged as T1, 10 patients as T3 and 22 patients as T4, respectively. Regional lymph node metastases was observed in 4 patients of T4 and in 1 patient of T3 (Table 3).

In our hospital treatment method was varia-

**Table 1. Histology of Maxillary Sinus Neoplasm Registered from 1986. 1 to 1992. 12**

Histologic type	No. of Patients (%)
Squamous cell	41(80.4)
Excluded	8
Eligible to study	33
Non-squamous cell	10(19.6)
Adenocarcinoma	2
Rhabdomyosarcoma	2
Mucoepidermoid	2
Adenoid cystic	1
Malignant lymphoma	1
Malignant fibrous histiocytoma	1
Malignant hemangiopericytoma	1
Total	51(100.0)

**Table 2. Characteristics of 33 Patients of Squamous Cell Carcinoma Eligible**

Characteristics	No. of Patients
Sex	
Male	24
Female	9
Age	
30-39	3
40-49	7
50-59	13
60-69	9
70-	1
Presenting Symptoms	
Tender swelling of cheek	23
Nasal discharge	9
Nasal obstruction	8
Headache	8
Nasal bleeding	5
Toothache	4
Trismus	3
Hearing loss	1
Diplopia	1

ble, so we classified them to 3 groups according to the management method applied to each patients. The first treatment group, named as "FAR", was consisted of preoperative intra-arterial chemotherapy through the superficial temporal artery with concomittant radiation and vitamin A(50,000 IU,daily) followed by total maxillectomy and postoperative radiation therapy(16/33). Among 16 patients of FAR group maxillectomy was not performed in 5 patients, and 2 patients did not receive postoperative radiation. Among 16 patients ten received total maxillectomy and 1 patient received partial maxillectomy. Preoperative radiation dose was ranged between 2600cGy and 4000cGy(Mean, 3433cGy). Postoperative radiation dose was between 1000cGy and 3420cGy(Mean, 2351cGy). Total dose ranged from 3960cGy to 6480cGy(mean:5255cGy, TDF;76). Preoperative chemotherapeutic agent was mostly 5-FU(mean dosage, 3078mg). A

**Table 3. Stage Distribution according to 1988 AJCC Staging System**

stage	No. of Patients(%)
T2	1( 3.0)
T3	10(30.3)
N0	9
N1	1
T4	22(66.7)
N0	18
N1	3
N2b	1
Total	33(100.0)

patient was treated with cisplatinum and bleomycin in stead of 5-FU. The second group, named as "SR", was treated with total maxillectomy followed by postoperative radiation therapy(7/33). In this cases postoperative radiation dose ranged between 5040cGy and 7020cGy(mean:5920cGy). The third group(6/33), named as "R", was treated with radiation alone, and radiation dose was delivered between 5040cGy and 9180 cGy with mean 7164cGy(mean TDF:107)(Table 4). Among 33 patients 2 patients received chemotherapy intravenously, otherwise same treatment schedules as FAR group. Of these one patient received combined trimodal therapy, but preoperative intraarterial chemotherapy and vitamin A was not performed. The other was treated with intraarterial chemotherapy and radical radiation therapy.

Radiation treatment was performed by standard fractionation schedule being daily 180-200 cGy and 5 times per week. 6 MV photon was used by linear accelerator. Radiation ports were composed of 2 or 3 anterior and lateral fields with wedge filter. We used custom-made block to protect the normal tissue.

We analysed local recurrence free survival, disease free survival and overall survival rate according to treatment group. Survival rate was calculated by Kaplan-Meier product limit method, and significance of survival difference

**Table 4. Groups of Patients according to Treatment Method**

Group	Treatment method	No. of patients
FAR	IA 5-FU(mean 3078mg) Vitamin A(50,000IU daily) Preop. RT(mean, 3433cGy) -> Total maxillectomy -> Postoperative radiation(mean, 2351cGy)	16
	completely treated	9
	incompletely treated	7
	no operation	5
	no postop. radiation	2
SR	Total maxillectomy -> postop. radiation(mean, 5920cGy)	7
R	Radiation therapy alone(mean, 7164cGy)	6

Abbreviations : FAR, 5-FU+Vitamin A+Radiation; IA, intraarterial; SR, surgery+radiation; R, radiation.

between two groups was tested by Mantel-Cox method. Median follow up period of 33 patients was 19 months. Information about survival status was obtained with physical examination and mail in 82%(27/33)of patients.

## RESULTS

The 2 year local recurrence free, disease free and overall survival rate of 33 patients was 62%, 41.7%, 63.7%, respectively.

Of 16 patients of FAR group 9 patients received the planned treatment completely. They all revealed control of local disease at 2 years (100%). 7 patients have not finished treatment completely. Five patients of 7 incompletely treated patients have not received total maxillectomy. Among them two patients recurred locally in 9 month and 17 month, respectively. Two patients are alive without disease at 31 and 53 months, respectively. A patient was lost at 18 months. Two patients of seven incompletely treated patients have not received the postoperative radiation therapy. One patient who was in stage of T4N0M0 was died of respiratory failure postoperatively.

The other patient, T3N0M0, was treated with chemoirradiation with total maxillectomy without postoperative radiation and he was lost to follow up at 7 months(Table 5).

Of 7 patients of SR group who had been planned with total maxillectomy and postoperative radiation therapy, 6 patients received the treatment completely. Among them 3 patients developed local recurrence(50%) at 4, 4, 7 month respectively. One patient with T3N0M0 disease had received postoperative radiation therapy up to 2700cGy, and he developed metastases to thoracic spine without evidence of local recurrence(Table 6).

Six patients were treated with radiation alone. Of those planned dose was completely delivered in 5 patients, and only one revealed complete remission. One of 6 patients received 3060cGy resulting minimal response and survived for 20 months(Table 7).

For comparison of survival difference between treatment modality we included the patients completely treated in statistics. As a result local recurrence free survival rate in the end of 2 year was 100%, 50%, and 0% in FAR(9/9), SR(3/6) and R(0/5) group, respectively. The difference between FAR group and SR group( $p < 0.05$ ), FAR group and R group( $p < 0.01$ ), were statistically significant respectively(Table 8). But The difference between SR and R group was not significant( $p > 0.05$ )(Fig. 1). The disease free survival rate of FAR, SR, R group were 88.9%, 28.6%, 0% respectively. The difference between FAR and SR group( $p < 0.01$ ), FAR and R group( $p < 0.01$ ) were statistically significant. But difference between SR and R group was not significant( $p > 0.05$ )(Fig. 2). The overall 2 year survival rate of FAR, SR and R group were, 88.9%, 40% and 50%, respectively. The difference between FAR and SR group( $p < 0.05$ ), FAR and R group ( $p < 0.01$ ), were statistically significant. But the difference between SR and R group was not significant( $p > 0.05$ )(Fig. 3).

**Table 5. Details of 16 Patients Treated with FAR Plan**

Age/Sex/stage	Treatment				Survival(M)
	5-FU(mg),	RT(cGy)/	Maxillectomy/RT(cGy)		LRF / DF / OV
51.f/T4NOMO	1975	3060	Denker's	3060	58 58 58 A
62/F/T4NOMO	2000	3420	Total	2520	77 77 77 A
31/M/T4NOMO	750	3060	Total	3420	68 68 68 A
55/F/T4NOMO	2750	2600	Total	2600	63 63 63 A
54/M/T4NOMO	2750	3000	Total	1260	21 19 21 D
64/M/T4N2bMO	3000	3740	Total	1260	54 54 54 A
41/M/T4N1MO	4650	4000	Total	1000	54 54 54 A
45/M/T4NOMO	6750	4000	Total	*	53 53 53 A
47/F/T4NOMO	#	3960	Total	*	45 45 45 A
61/M/T3NOMO	1450	3000	Total	No	7 7 30 D
67/M/T4NOMO	1400	2080	Total	No	2 2 2 D
64/M/T2NOMO	2250	3060	No	No	53 53 53 A
56/M/T3NOMO	1425	3000	No	No	18 18 18 A
65/M/T3NOMO	2550	3060	No	No	31 31 31 A
59/M/T3NOMO	-	3420	No	No	17 17 23 A
53/M/T4NOMO	4575	2700	No	No	9 9 9 D

# Two cycles with cisplatinium and bleomycin was performed.

Abbreviations : LRF, locoregional recurrence free; DF, disease free; Ov, overall ; A, alive; D, dead.

\* Planned treatment was finished without postoperative radiotherapy.

**Table 6. Details of 7 Patients Treated with SR Plan**

Age/Sex/Stage	Treatment		Survival(M)
		Maxillectomy/RT(cGy)	LRF/DF/OV
55/F/T4NOMO	Total	7020	7 7 9 A
58/F/T3NOMO	Total	5580	7 5 7 A
66/F/T3NOMO	Total	6480	4 4 4 L
44/M/T4NOMO	Total	5400	15 15 15 D
53/M/T3NOMO	Total	2700	3 1 3 L
58/M/T4NOMO	Partial	6000	4 4 6 D
49/M/T4NOMO	Partial	5040	19 19 19 A

Abbreviations : LRF, locoregional recurrence free; DF, disease free; Ov, overall; A, alive; D, dead; L, lost.

**Table 7. Details of 6 Patients Treated with R Plan**

Age/Sex/Stage	Treatment		Survival(M)
		RT(cGy)	LRF/DF/OV
56/M/T4NOMO		5040	7 7 9 A
37/M/T4N1MO		7560	7 5 7 A
39/M/T4N1MO		3060	4 4 4 L
53/M/T3N1MO		7740	15 15 15 D
53/M/T4NOMO		6300	3 1 3 L
49/M/T4NOMO		9180	4 4 6 D
			19 19 19 A

Abbreviations : LRF, locoregional recurrence free; DF, disease free; Ov, overall; A, alive; D, dead; L, lost.

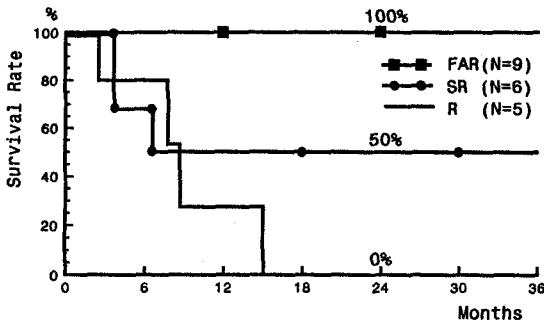
## DISCUSSION

Maxillary sinus carcinomas are relatively rare. Therefore, it is difficult for a single institution

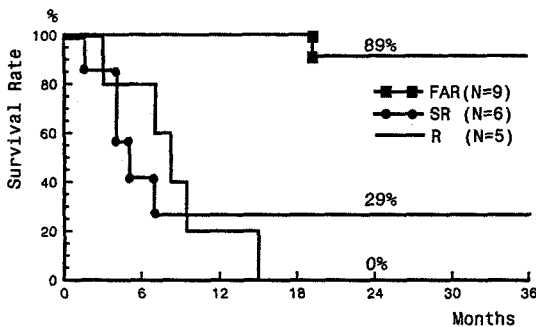
to have much experience in their management<sup>3-5)</sup>. Authors experienced fifty one patients of maxillary sinus carcinoma visited Departemnt of Therapeutic Radiology, Chonnam University Hospital through 1986 to 1992.

**Table 8. 2 Year Survival Rate and Summary of Statistics**

Group	Actuarial survival rate								
	L-R free			Dis free			Overall		
	FAR	SR	R	FAR	SR	R	FAR	SR	R
Percent	100	50	0	88.9	28.6	0	88.9	40	50
Significance									
	FAR vs SR : P<0.05			FAR vs SR : P<0.01			FAR vs SR : P<0.05		
	FAR vs R : P<0.01			FAR vs R : P<0.01			FAR vs R : P<0.01		
	SR vs R : N.S.			SR vs R : N.S.			SR vs R : N.S.		

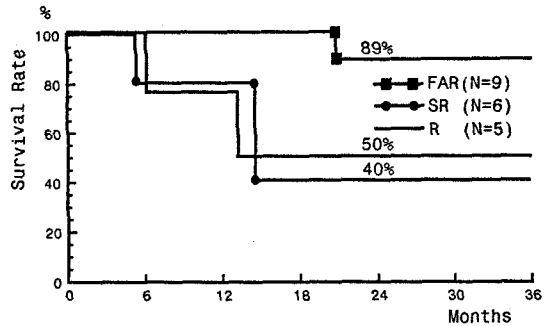


**Fig. 1.** 2 year locoregional recurrence free survival rate: FAR group shows better results than SR(p<0.05) or R(p<0.01), but not significant difference between SR and R (p>0.05).



**Fig. 2.** 2 year disease free survival rate: FAR group shows better results than SR(p<0.01) or R(p<0.01), but not significant difference between SR and R(p>0.05).

A uniform staging system for maxillary sinus carcinoma has not been adopted and make the literature difficult to interpret<sup>6)</sup>. Zamora et al<sup>7)</sup>



**Fig. 3.** 2 year overall survival rate: FAR group shows better results than SR(p<0.05) or R(p<0.01), but not significant difference between SR and R(p>0.05).

reported that there is a significant difference in survival between T3 and T4 lesions of the 1988 systems, but not in the 1983 system. In this study all the patients were restaged according to the 1988 AJCC staging system<sup>2)</sup>.

Maxillary sinus cancers are seldom diagnosed in early stages because early symptoms of malignant and inflammatory disease are indistinguishable. As a result these patients are locally advanced and invade the structures that surround the sinus, such as orbits, ethmoid sinus, sphenoid sinus, base of skull and oral cavity<sup>1)</sup>. In this study most of the patients presented locally advanced T3(10/33) and T4(22/33) lesions, and this is similar to other authors' reports<sup>3,8)</sup>. Maxillary sinus carcinomas tend to remain localized for long periods and involve adjacent structures, so local control is important toward cure.

The tumor location has been considered as a prognostic factor. Some authors suggest that infrastructure lesion have a worse prognosis than those involving the suprastructure<sup>9)</sup>, and others suggest contradictory result<sup>10)</sup>. In this study three patients revealed main lesion arising infrastructure. We did not analyse survival rate separately according to the tumor location because of small case numbers. The metastases to neck node is associated with poor local control and survival. But cervical lymph node metastases is infrequent ranging 5

to 25% of patients<sup>3-6</sup>). In our study 5 of 33 patients (15%) showed metastases in cervical node at diagnosis. Two patients were treated with FAR plan and survived 53 and 54 months, respectively. Three patients were treated with radiation alone. They survived 8, 9, 20 months respectively.

There has been much controversy about proper management of maxillary sinus cancer. Because of rarity of this disease it has uncertainty to compare the results of each treatments. In the treatment of maxillary sinus carcinoma chemotherapy, surgery and radiation were used alone or by combination of two or more. Because of the advanced stage of the disease, a policy of combined treatment is generally accepted as the most effective means of enhancing cure rates<sup>11-13</sup>). In general, 5-year survival of 25% to 45% with surgery or radiotherapy alone or in combination is quoted<sup>3,13-16</sup>). Local control rate is ranging from 38% to 73% in T3 lesion and 33% to 50% in T4 on the literature<sup>3,12,17-19</sup>). In our study median follow up period was 19 months, so we obtained 2 year survival rate according to the treatment methods. The 2 year local recurrence free survival rate in the end of 2 year was 100%, 50% and 0% in FAR, SR and R group, respectively. The 2 year disease free survival rate in 2 years was 88.9%, 28.6% and 0% in FAR, SR and R group, respectively. Overall 2 year survival rate was 88.9%, 40% and 50% in FAR, SR and R group, respectively. There were statistically significant difference between FAR and SR or FAR and R group in their local recurrence free, disease free and overall survival rates. But difference of each survival rate between SR and R group was not significant. This result revealed that FAR group treated with combination modality of chemotherapy, surgery and radiation had better outcome. Because a large proportion of patients are unresectable at diagnosis or have positive margins after surgery, so radiation therapy plays an important role in the manage-

ment of these tumors<sup>3,6</sup>). There is no consensus to the best time for radiation, before or after surgery. Several series report similar results with preoperative or postoperative radiotherapy<sup>10,20</sup>). The rationale for using postoperative radiotherapy is that with the bulk of the tumor removed by surgery, only small foci of residual disease would remain which theoretically could be controlled by radical radiotherapy<sup>6</sup>). On the other hand, there are authors who report that preoperative radiotherapy renders better results<sup>3,21</sup>). Preoperative radiation therapy may be used to debulk these tumors.

Giri et al<sup>3</sup>) reported that patients treated with a dose in excess of 6500 cGy achieved better local control than those receiving less than this dose, this was statistically significant. And the dose of preoperative RT was recommended at least 5500 to 6000 cGy. In our study trimodal combination therapy group received mean radiation dose of 3433 cGy preoperatively and 2351 cGy postoperatively, respectively. Mean total radiation dose was 5255 cGy. It is about 300 to 800 cGy less than generally recommended dose of adjuvant radiation therapy in maxillary sinus carcinoma. The sandwich type radiation therapy as in our hospital could provide advantages of both preoperative and postoperative radiation therapy. In the surgery and radiation group mean total dose of radiation was 5920 cGy and was comparable to other reports. In radiation therapy alone group mean total dose was 7164 cGy. The total dose that can be delivered to this area is limited by the tolerance of the eye and brain. So trimodal combination therapy has an advantage of dose reduction to this critical normal tissue compared with radiation therapy alone.

Conventional trimodal combination therapy composed of antrotomy, radiotherapy, and intra-arterial chemotherapy. Shibuya et al<sup>22,23</sup>) reported that conventional trimodal therapy did not give a good survival rate, and this therapy sometimes resulted in a local lack of control

and recurrences in the region where only poorly vascularized. And they noted that in the therapy planning minor surgery following conventional trimodal therapy local recurrence has been sharply decreased. In our patients daily necrotomy was performed with soaking of 5-FU gauze in the maxillary sinus antrum during preoperative treatment period. Sakata et al<sup>1)</sup> also obtained best results in patients treated with combination trimodal therapy and noted that multiports of irregular fields and conformation therapy make it possible to deliver higher doses on target with reduced complication and have contributed to the improved local control.

Recent reports in the literature suggest that the addition of chemotherapy to surgery and/or radiation therapy may improve survival<sup>17)</sup>. The purpose of simultaneous chemoradiotherapy is to increase locoregional control and prevent distant metastases. The possible synergistic effect has been explained by supposing that the drugs interfere with cell repair after sublethal or potentially lethal damage or with tumor cell synchronization<sup>24)</sup>. Shigematsu et al<sup>25)</sup> achieved better disease free survival at randomized trial with intraarterial 5-fluorouracil and radiation therapy, but similar overall survival between two groups. In the randomized study by Lo et al<sup>26)</sup> 5 year survival was significantly better only in the oral cavity patients. Recently at the M.D.Anderson Cancer Center intraarterial cisplatin and bleomycin, and intravenous 5-FU infusion were used as an induction regimen with advanced paranasal sinus cancers<sup>27)</sup>. Of 28 patients 19 achieved (67%) the results more than PR. In Wane State cisplatin base intravenous chemotherapy was used in 24 patients<sup>28)</sup>. They achieved complete response in 44% and partial response in 38% for previously untreated patients.

There has been debate as to the advantage of intraarterial infusion of chemotherapy agents<sup>17,23,29)</sup>. Shibuya et al<sup>22)</sup> demonstrated irregular distribution of intraarterially infused drug be-

cause of the existence of feeding arteries other than maxillary artery for the maxillary carcinoma. But Sakata et al<sup>1)</sup> noted that intraarterial chemotherapy with 5-FU and cisplatin might have contributed to improve local control in their patients. There remains a question that intraarterial chemotherapy with 5-FU can reduce the radiation dose without affecting the local control or survival rate. For patients with advanced paranasal sinus cancer who need orbital exenteration or major craniofacial resection, the option of intraarterial chemotherapy as induction therapy to preserve the eye can be considered as an alternative treatment<sup>24)</sup>.

In conclusion combination treatment, composed of intraarterial chemotherapy through the superficial temporal artery with concomitant vitamin A and radiation followed by total maxillectomy and postoperative radiation, revealed better locoregional free, disease free and overall survival rate than the treatment by surgery and radiation or radiation therapy alone. In the future prospective randomized study is in need for this trimodal combination therapy including intra-arterial induction chemotherapy in maxillary sinus carcinoma.

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= 국문초록 =

### 상악동암의 치료 방법에 따른 성적 비교

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**목 적 :** 상악동암의 적절한 치료 방법을 알기 위하여 후향적 분석을 시행하였다.

**대상 및 방법 :** 1986년 1월 부터 1992년 12월 까지 전남대학교 병원에서 치료받은 상악동에서 발생한 편평상피세포암 33명을 대상으로 하였다. 남자가 24명 여자가 9명이었고 연령의 중앙값은 55세였다. 1988년에 제시된 AJCC 병기 분류법에 따른 종양의 병기는 T2 1명, T3 10명, T4 22명이었으며 경부임파절 전이는 5명에서 관찰되었다(N1:4명, N2b:1명). 치료방법에 따라 3군으로 분류하여 분석하였으며 첫 군(FAR 군으로 명명, 16명)은 수술전 경동맥 함암화학요법(5-FU, 평균 3078mg)과 방사선치료(평균 3433cGy) 및 비타민 A(50,000 IU, daily)를 병용하고 이어서 상악전적출술 과 술 후 방사선치료(평균 2351cGy)를 시행하였다. 방사선총량은 5255cGy였다. 둘째군(SR 군으로 명명, 7명)은 상악전적출술과 술후 방사선 치료(평균 5920cGy)를 시행하였다. 셋째군(R 군으로 명명, 6명)은 근치적 목적의 방사선 치료(평균 7164cGy)만 시행하였다. 생존율 분석에는 Kaplan-Meier법을 이용하였고 두 군간의 차이에 대한 검정은 Mantel-Cox법으로 하였다.

**결 과 :** 국소종양 제어율은 2년에 FAR, SR, R군에서 각각 100%, 50%, 27.7%로 나타났다. 무병 생존율은 2년에 FAR, SR, R군에서 각각 88.9%, 33.3%, 0%였다. 전체적인 생존율은 2년에 FAR, SR, R군에서 각각 88.9%, 40%, 50%였다. FAR군과 SR군간에, 그리고 FAR군과 R군간에 국소종양 제어율, 2년 무병생존율, 2년 생존율에 있어서의 차이는 통계학적으로 유의하였다. 그러나 SR군과 R군간의 차이는 통계학적 유의성이 없었다.

**결 론 :** 수술전 경동맥 5-FU와 비타민 A 그리고 방사선 치료를 병용 치료하여 종양의 부분적 관해를 유도한 후 상악전적출술과 추가적인 방사선 치료를 시행한 FAR군이 상악전적출술후 방사선치료를 시행한 군이나 방사선 단독치료군보다 더 좋은 성적을 보였다. 앞으로 이에 대한 전향적 연구가 필요할 것으로 사료된다.

주요어: 상악동암, 치료성적, 생존율