

# Radiation of Jejunal Interposition in T<sub>3</sub>-T<sub>4</sub> Upper Aerodigestive Tumours

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30 patients with T<sub>3</sub> and T<sub>4</sub> tumours of the upper aerodigestive tract had their tumours resected by pharyngolaryngectomy. This was followed by reconstruction of a gullet or creation of a siphon as a tracheohypopharyngeal shunt for voice restoration with a free jejunal autograft. All patients were treated postoperatively with <sup>60</sup>Co gamma radiation, 6 MeV photons or 7.5 to 10 MeV electrons of a β-tron, with a dose of 50-65 Gy in the area of the primary tumour and 50-65 Gy to the neck. 4 patients refused further treatment after a depth dose of between 16 and 32 Gy. Local recurrence occurred in 40% of cases. The survival rate was 36.6% (11/30) after a mean follow-up time of 21.5 months, although 2 patients died of intercurrent diseases without recurrence of their tumours. The results obtained justify active surgical intervention with postoperative irradiation even at an advanced stage of the tumour.

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## INTRODUCTION

PATIENTS WITH T<sub>3</sub> and T<sub>4</sub> tumours of the upper aerodigestive tract have a very restricted life expectancy, the severity of which is dependent upon the stage of the tumour [1, 2]. Over and above this, in many cases functional impairment of breathing and swallowing also represents a severe affliction. The therapeutic measures which can be taken into consideration are surgery and/or radiotherapy (RT) [3-5]. A third option is chemotherapy, although its value is not yet proven in controlled trials [6-8]. Of the various approaches free transplantation of a microvascular anastomosed jejunal section has proved to be effective, to the extent that reconstructive surgery can be carried out immediately

after resection of the tumour [4, 5, 9, 10]. Thus enabling a satisfactory solution for speech, swallowing, and aesthetics to be found. In these patients postoperative radiotherapy is carried out not only in order to destroy micrometastases but also to maximise the recurrence free life interval and, in this sense, also enhance the quality of life. Our main question is to investigate whether the radiotherapy is well tolerated by the interposition graft and if functional damages are to be expected.

## PATIENTS AND METHODS

A total of 30 patients (27 men and 3 women) with advanced tumours of the oropharynx, hypopharynx and larynx (Table 1)

Table 1. Primary tumour localisation/pT and pN stage [11]

Localisation	pT stage	pN stage	No. of cases	No. of radical resections
Oropharynx	T <sub>3</sub>	N <sub>1</sub>	1	1
	T <sub>4</sub>	N <sub>0</sub>	2	2
	T <sub>4</sub>	N <sub>1</sub>	3	2
	T <sub>4</sub>	N <sub>3</sub>	1	0
	T <sub>4</sub>	N <sub>x</sub> *	1	0
Hypopharynx	T <sub>3</sub>	N <sub>2</sub>	1	1
	T <sub>3</sub>	N <sub>3</sub>	1	0
	T <sub>4</sub>	N <sub>0</sub>	1	1
	T <sub>4</sub>	N <sub>1</sub>	1	1
	T <sub>4</sub>	N <sub>2</sub>	2	1
	T <sub>4</sub>	N <sub>3</sub>	7	2
Larynx	T <sub>3</sub>	N <sub>0</sub>	2	2
	T <sub>3</sub>	N <sub>3</sub>	2	2
	T <sub>4</sub>	N <sub>0</sub>	2	2
	T <sub>4</sub>	N <sub>1</sub>	1	1
	T <sub>4</sub>	N <sub>2</sub>	1	1
	T <sub>4</sub>	N <sub>3</sub>	1	0

\* NX = N1 verified by ultrasound, patient refused neck dissection.

underwent surgery and radiotherapy in the period from 1982 to 1988. The youngest patient was 41 years of age, the oldest 76, the average was approximately 55. In 8 patients the primary tumour was localised in the oropharynx, in 13 cases in the hypopharynx and in 9 cases in the larynx. Local preoperative staging was carried out on the basis of the ear, nose and throat (ENT) examination and ultrasound of the neck to determine the condition of the lymph nodes. Tumour/node/metastasis (TNM) status was classified according to TNM/pTNM classification, 1985 [11]. The extent of tumour-resection in the surrounding tissue varied, as did the degree of reconstructive surgery, although in each case a freely transplantable jejunal segment was used. Depending on the preoperative lymph node-status and the intraoperative frozen sections from suspect lymph nodes we did primarily radical, functional radical or supraomohyoid neck dissections. On one side the cervical vessels were exposed with the utmost caution for later anastomoses. When the posterior wall of the pharynx was preserved and we wanted to obtain immediate voice rehabilitation, a siphon-like tracheo-hypopharyngeal loop was inserted (15 cases). In 5 cases the size of the pharyngeal wall defect forced us to combine the siphon with a patch (3 patients) or even with a tube (2 patients), when total pharyngectomy had been done.

In 10 cases the jejunum graft was only used for covering the pharyngeal defect to reconstruct the upper swallowing tract. When the defect was partial, the jejunum graft was opened antimesenterially and inserted as a patch (7 cases), after total pharyngectomy the graft was used as a tube (3 cases). Histologically all patients had a squamous cell carcinoma. The operation was radical in 19 patients. In 11 cases resection was not carried out radically in healthy tissue. The precise pathological T and

N classification with respect to primary tumour localisation can be seen from Table 1.

#### Radiotherapy (RT)

Patients underwent RT 5–6 weeks postoperatively, without split course under high voltage conditions (<sup>60</sup>Co, 6 MeV photons, 7.5–10 MeV fast electrons of a β-tron).

Radiation was given over two opposed lateral fields (isocenter technique) in 2 Gy fractions 5 days/week.

Computer-tomography (CT) scans were used for treatment planning. The dose was calculated within the 90% isodose. A support aid constructed to the specifications of each individual patient was used for radiation planning and the treatment.

If the operation of the primary was histologically radical a minimum dose of 50 Gy was delivered to the tumour bed/graft.

In case of histologically positive margins 60–66 Gy were delivered. The neck was irradiated up to 50 Gy in case of negative regional lymph nodes. 60 Gy were delivered if histologically examination showed positive lymph nodes. A small volume boost up to 66–70 Gy was given when a macroscopic tumour rest and/or vessel infiltration could not be removed.

After 35 Gy the lymph nodes behind the plane of the spinal cord were treated with 7.5–10 MeV electrons.

#### Follow-up and survival

At the end of the observation period, which was 58 months in the longest case and 6 months in the shortest case, 11 patients out of 30 were still alive, all of whom were without tumours.

19 patients died. 16 of these as a result of local recurrence and 1 patient of distant metastasis without indication of local tumour development. 2 patients died as a result of intercurrent disease without tumours.

In 4 out of the 16 patients who developed local recurrence radiotherapy had to be interrupted after a depth dose of between 16 and 32 Gy—three times due to lack of cooperation on the part of the patients, 1 patient developed severe mucositis (grade 3). The cumulative proportion surviving can be seen from Fig. 1. The median survival time was 17 months, the mean follow-up time of living persons was 21.5 months. When the histological reports were checked with respect to radical surgery, it was found that in all cases where patients survived, resection had been radical.

In the radical resected group 11 out of 19 patients survived whereas no patient survived in the incomplete resected group.

#### Side effects and functional outcome

For acute side effects were classified according to recommendations of the WHO. For grading of mucosal side effects see Table 2, [12]. For grading of cutaneous side effects see Table 3, [12].

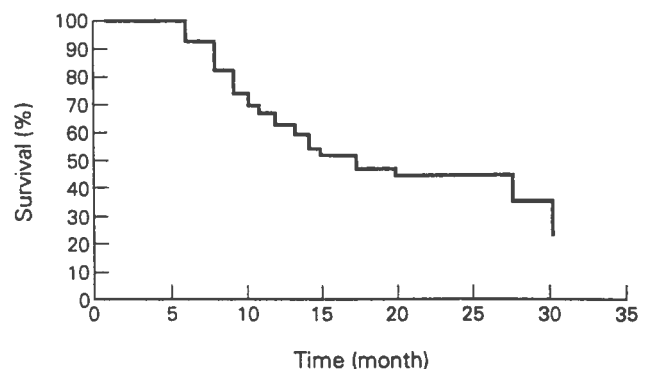


Fig. 1. Cumulative proportion surviving/survival time for 30 patients with T<sub>3</sub>-T<sub>4</sub> head and neck tumours after surgery and RT.

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Table 2. Grading of acute mucosal side effects [12] in the upper aerodigestive tract

	No. of patients
Grade 0 (none)	2
Grade I (soreness/erythema)	27
Grade II (erythema, ulcers, can eat solids)	5
Grade III (ulcers, requires liquid diet only)	1
Grade IV (alimentation not possible)	0

Late side effects included: dry mouth (5 patients), taste impairment (1 patient), hyppgeusia (2 patients), persistent hoarseness (1 patient). No severe late side effects of the skin were found.

Three criteria were applied in order to evaluate the function of the transplant after radiation: speaking, swallowing and cosmetical results.

## RESULTS

### Speech rehabilitation

20 patients were operated with the aim of immediate speech rehabilitation (15 siphons and 5 combinations of siphon and patch or tube). In 19 (95%) of these patients voice rehabilitation succeeded. The 1 patient, in whom voice function could not be obtained, developed a local recurrence next to the tracheostomy within 1 month.

The physicians treating these patients found that phonation started on average 11.5 (range 10–15) days postoperatively. After short training in the 19 patients, understandable speech resulted: very good, 16 cases; good, 2 cases; and moderate, 1 case.

Therefore these 19 patients could be integrated into their family lives early. There were primarily no remarkable swallowing disorders in any case.

### Swallowing restoration

For this function we evaluated 10 patients with the only aim of reconstructing the swallowing act (7 patients with patch and 3 patients with a tube). In 3 cases restoration of satisfactory swallowing failed: 2 immediate local recurrences and one chron-

ical transplant oedema). The other 7 patients (70%) learned to swallow. Patients started swallowing on average 12.7 days postoperatively (range 10–17). 6 of the 7 patients could intake all foods, the remaining one of them could only swallow soft food. Additionally speech rehabilitation succeeded only in 3 cases via the oesophageal speech.

### Cosmetic restoration

In the course of follow up examinations the physicians found out that although all patients had to have a tracheostomy the cosmetical result was very good in 25 patients, moderate in 3 and poor in 2 of them. (One patient with postoperative partial necrosis of the skin-platysma flap, 1 patient with a pharyngocutaneous fistula (both were covered with a myocutaneous pectoralis major flap).

### Complications

Only 1 patient suffered necrosis of the transplant. This happened postoperatively before radiotherapy had been administered. After retransplantation radiotherapy did not cause any complication.

## DISCUSSION

Advanced tumours of the aerodigestive tract necessitate a complex therapeutic procedure. Various surgical techniques can be used, although the impossibility of reconstructing the pharynx represents a limiting factor. It has therefore proved expedient to use a free jejunal transfer [4, 5, 9, 10]. In view of the fact that life expectancy is already very limited, the major advantages of this method are a single surgical operation, an almost unlimited availability of transplants, few complications, feeding very soon after surgery and good cosmetic results [2, 5, 13]. A further advantage is that the length of the graft may be tailored to fit the defect, the resection and reconstruction are completed in a single stage and fistula and stricture are less likely than when skin flaps are used to reconstruct the defect. A postoperative complication rate of only 3.3% (1/30) can be regarded as very low. After retransplantation in 1 patient who suffered necrosis of the transplant radiotherapy did not cause any complication. Good to excellent functional results were achieved in 63% (19/30) of cases. This coincides with those given in the literature [3]. RT is applied exclusively with a view of improving local control. The doses which we applied to the primary and to the neck correspond to those recommended by other authors [3]. These doses were also well tolerated [12]. In our opinion, therefore, patients with jejunal interposition should also receive adequate radiation therapy which increases the recurrence free interval. Our results point out that there is no need to worry about radiation induced injury to the interposition graft. Although a recurrence rate of 40% in this heterogeneous group of patients must be regarded as high, this must be seen in the light of the advanced condition of the tumours. Considering the short survival time of patients with T<sub>3</sub> and T<sub>4</sub> tumours improvement of functional outcome with acceptable treatment related side effects which means increasing quality of life is the most important aspect for this interdisciplinary therapeutic approach.

Table 3. Grading of acute cutaneous side effects [12]

	No. of patients
Grade 0 (none)	0
Grade I (erythema)	6
Grade II (dry desquamation, vesiculation, pruritus)	19
Grade III (moist desquamation, ulceration)	5
Grade IV (necrosis requiring surgical intervention)	0

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