

Reconstruction using free jejunal transfer after resection of cancer of the upper oesophagus

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ABSTRACT

INTRODUCTION: Treatment of cancer of the upper part of the oesophagus is challenging. Even after intended curative treatment, less than half of the patients are alive after five years. This retrospective study evaluates all the patients who had the upper oesophagus reconstructed by use of a free jejunal transfer following cancer resection from February 2000 to May 2008 at the University Hospital of Aarhus.

MATERIAL AND METHODS: Twenty patients aged 46-75 years were included. In all 20 cases, the diagnosis was squamous cell carcinoma, T3 or T4. All patients suffered from severe dysphagia prior to surgery. The median follow-up time was 23 months at 31 January 2010.

RESULTS: No perioperative mortality was experienced. Thirteen patients are now dead; nine due to the cancer of the oesophagus and four due to other causes. The median survival time of the 13 diseased patients was 15.3 months. The seven patients who remain alive have a median survival time of 40.2 months. None of these patients have shown signs of recurrence of the oesophageal cancer. All the patients regained their capacity to swallow and thereby increased their quality of life. No complications were experienced in relation to the abdominal procedure of harvesting the jejunal transfer. Three patients developed a fistula and in one case this required minor surgery. Eight patients needed to have a dilatation procedure performed. **CONCLUSION:** Reconstruction of the oesophagus with a free jejunal transfer is a suitable treatment for selected patients with cancer in the upper oesophagus.

The principal symptoms of carcinoma of the upper oesophagus are dysphagia and subsequent weight loss. The prognosis is poor with an estimated five-year survival of 10-40% [1-3].

Intended curative treatment is multimodal and involves preoperative chemoradiotherapy followed by extensive surgery including laryngectomy and reconstruction of the upper part of the oesophagus. Treatment-related acute and late morbidity is substantial and greatly affects the patient's quality of life. Adding to the poor survival expectancy, perioperative mortality has historically reached 20%. Curative treatment should therefore be reserved for selected patients.

Many techniques have been used to obtain a definite and operational reconstruction after resection of cancer of the upper oesophagus. Multi-stage surgery entailing several long-lasting hospitalizations was previously used causing patient discomfort and involving substantial hospital costs. Implementation of modern reconstructive surgical techniques using free tissue transfers has rendered possible primary reconstruction of the upper part of the oesophagus in a one-stage procedure.

The purpose of this study was to evaluate the survival of patients and their functional capability following reconstruction of the upper oesophagus using free jejunal transfer.

MATERIAL AND METHODS

This is a retrospective evaluation of 20 patients who underwent resection of cancer of the upper oesophagus followed by reconstruction using a free jejunal interposition. Surgery was performed at Aarhus University Hospital during the period from February 2000 to May 2008. The patients' medical records were evaluated and special attention was paid to their history, description of the operation, preoperative chemoradiotherapy, survival of the reconstruction and the patient, and, finally, a dysphagia score was obtained using the European Organisation for Research and Treatment of Cancer questionnaire [4].

At Aarhus University Hospital, patients with cancer of the upper oesophagus are treated by a multidisciplinary team. Preoperative assessment is coordinated by the Department of Abdominal Surgery and comprises oesophagoscopy, laparoscopic ultrasonography, endoscopic ultrasound and computerized tomographic scanning of the chest and the abdomen together with magnetic resonance imaging of the neck region.

On the basis of these findings, the tumour is classified according to the Tumour-Node-Metastasis (TNM) classification of malignant tumours from the International Union Against Cancer, and optimal treatment can then be decided [5]. If tumour location does not preclude a surgical approach, the patient is offered surgery, and it is decided if preoperative chemoradiotherapy is indicated. Neoadjuvant chemoradiotherapy is administered over a period of nine weeks. The irradi-

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ation dose is 45 Gy which is given as 1.8 Gy per fraction over five weeks together with 5-fluoracil as a continuous 24-hour infusion either alone or in conjunction with weekly cisplatin or cisplatin given three times over the course of the nine weeks. Two weeks after neoadjuvant treatment, surgery is performed. The excision of the cancer is done by an ear-nose-throat surgeon and a thoracic surgeon, and the same staff perform the enteric anastomoses for interposing the free isoperistaltic jejunal transfer. In parallel with the ablative surgery, the jejunal segment is prepared for transfer by an abdominal surgeon and a plastic surgeon (**Figure 1**). Once the

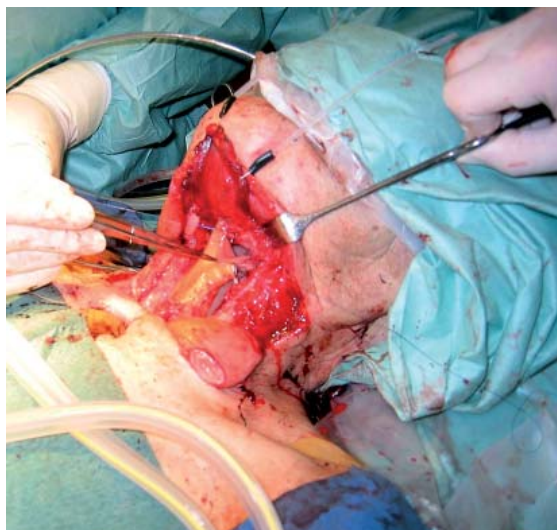
 **FIGURE 1**

A jejunal segment is prepared for transfer.



 **FIGURE 2**

The upper part of the oesophagus is reconstructed with a free jejunal transfer.



jejunal transfer has been sutured to the base of tongue and the remaining part of the oesophagus, the plastic surgeon revascularises the jejunum by anastomising the jejunal vessels to recipient neck region vessels which have been dissected free (**Figure 2**).

The survival of the jejunal segment is monitored by use of microdialysis [6]. An exteriorized jejunal monitoring segment, which can be inspected at the front of the neck, works as a surveillance backup [7]. The jejunal monitoring segment consists of a minor jejunal segment which does not form part of the reconstruction, but shares blood supply with the segment engaged in the reconstruction. The microdialysis catheter and the exteriorized segment are removed five to seven days after surgery.

STATISTICS AND FOLLOW-UP

The results of the present study were obtained on 31 January 2010. The median follow-up time was 23 months (3.7-78.5).

For follow-up, patients were seen at the outpatient clinic every three months during the first year after surgery. Subsequently, patients were seen every six months until five years had passed. Whenever needed, an oesophagoscopy or a roentgenological examination was performed.

RESULTS

A total of 29 patients with cancer of the upper part of the oesophagus were assessed and in nine cases the planned operation was not performed. In six cases the operation was cancelled because curative treatment could not be expected and in three cases the plan was changed during the operation. Twenty patients (13 men and seven women) aged from 46 to 75 years (median 60) had surgery and had the upper oesophagus reconstructed by use of a free jejunal transfer (**Table 1**). In one case, the reconstruction was combined with a gastric pull-up because a reconstruction exceeding 25 cm was needed. The histopathological diagnosis was squamous cell carcinoma in all 20 cases. Thirteen tumours were T3 and seven were T4. Sixteen of the 20 patients were heavy smokers and 12 had substantial alcohol consumption. The patients' median body mass index was 20 kg/m² (range 11-26).

Six among the 20 patients in this study were previously diagnosed and treated for cancer in the neck region: cancer of the larynx (4), the tonsils (1) and the oesophagus (1). All these six patients had previously received radiotherapy to the neck region. Ten of the 14 patients who had not previously been irradiated received neoadjuvant chemoradiation prior to tumour resection. The rest (4) did not receive neoadjuvant chemoradiation as it was not being offered at that time.



TABLE 1

Overview of the 20 patients who underwent free jejunal transfer.

Patient	Stage	Previous irradiation	PreOP irradiation	Recurrence	Deceased	Follow-up, months	PreOP dysphagia score	PostOp dysphagia score	Complications
1	T3		x	x	x	78,5	4	0	
2	T3		x		x	37,5	3	0	
3	T3		x	x	x	22,1	3	0	Stricture
4	T3		x		x	16,0	4	0	
5	T3		x	x	x	3,7	3	3	Stricture
6	T3	X		x	x	8,8	3	3	
7	T4	X		x	x	25,6	4	0	Fistula
8	T3		x	x	x	14,5	2	1	Stricture
9	T4		x		x	51,1	2	1	
10	T4					70,2	1	1	
11	T3	X			x	7,8	4	1	
12	T4		x	x	x	6,5	3	3	
13	T3	X				62,7	3	0	
14	T3					57,1	4	0	Fistula
15	T3	X				41,5	4	0	
16	T4			x	x	22,7	3	1	Stricture
17	T3	X				38,9	4	0	Stricture
18	T4			x	x	12,9	4	4	
19	T3		x			32,8	3	0	
20	T3		x			21,2	3	0	Fistula, stricture

PreOP = preoperative. PostOP = postoperative.

The perioperative mortality rate was zero. The median duration of the operation was nine hours (range 6-12), and the median duration of primary ischaemia was 126 minutes (range 93-263). Three patients had a reoperation performed due to secondary ischaemia in the jejunal transfer. In all three cases, arterial spasms were observed in the recipient artery. In all cases, the jejunal interposition was revascularised and survived.

Prior to surgery, 17 of the 20 patients (85%) suffered from severe swallowing problems (**Figure 3**). The eight patients who were rated with a dysphagia score of four prior to surgery were unable even to swallow their saliva.

All patients were evaluated by oesophago-gastro-duodenoscopy 7-10 days after surgery. When a sufficient anastomosis was confirmed, oral intake was recommended, starting with watery fluids, and it was then escalated, matching the patient's ability to swallow. All patients regained their capacity to swallow after surgery. Three months after surgery, 16 of the 20 patients (89%) had achieved an improvement of their previous dysphagia score (< 2).

No patients developed complications related to the donor site due to mobilization of the free jejunal transfer. Three patients developed a fistula between the skin and the enteral anastomosis at the base of the tongue. Two of these fistulas healed spontaneously and in one case, minor surgical revision was needed. Eight patients

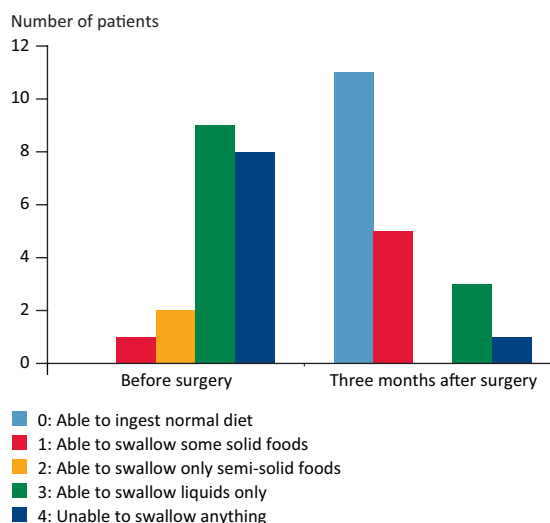
had dilatation performed due to stricture (6), crustal formation (1) and oedema and/or inflammation at the site of the jejunal transfer (1).

The median length of surgery-associated hospitalisation was 20 days (range 13-48). The patients who later died (13) were admitted to hospital for a median 3.6% of



FIGURE 3

Dysphagia scores before and three months after surgery.



their follow-up period (range 0.8–20.6%) as compared with the remaining seven patients who were admitted for a median of 1.2% of their follow-up period (range 1.0–3.9%).

In two cases, free section margins could not be achieved due to tumour invasion of the posterior tracheal wall. Free section margins were achieved in 18 patients (90%). Nevertheless, locoregional recurrence was later seen in seven of these 18 patients (39%). The median survival for the 20 patients was 80% after one year, 53% after two years, 44% after three years and 36% after five years.

At the time of analysis, 13 patients had died. The median survival time for these 13 patients was 15.3 months (range 3.7–78.5). Nine of these 13 patients died because of recurrence of the oesophageal cancer, whereas four patients died from other causes and with no sign of tumour recurrence. The median survival time for the seven patients who were still alive at the end of follow-up was 40.2 months (range 21.2–70.2). None of these seven patients had tumour recurrence as per 31 January 2010.

DISCUSSION

The challenges in treatment of cancer of the upper oesophagus lie in its poor prognosis and the need for surgical reconstruction of the removed upper part of the oesophagus. The poor five-year survival rate after intended curative treatment emphasizes the need to choose a treatment with low morbidity, brief hospitalisation and rapid restoration of the patient's ability to swallow, if possible.

Radical tumour ablation is essential for survival. However, irrespective of treatment method, the five-year survival has been reported to range from 10% to 40% [3]. In this study, the five-year survival was 36%. Seven patients are still alive at a follow-up from 21.2 up to 70.2 months and the seven patients have presented with no signs of recurrence of oesophageal cancer. This emphasizes the importance of careful patient selection before deciding on reconstruction with free jejunal transfer. Stronger prognostic and predictive markers are therefore still needed. If the intensive treatment schedule described here cannot be expected to cure the patient, other treatments should be considered with a view to palliation and to afford patients with an acceptable quality of life in their remaining lifetime [8].

Four of the 13 deceased patients in this study died without recurrence of their oesophageal cancer. The patient group included 80% heavy smokers and 60% with substantial alcohol consumption, both of which factors are known to be negative prognostic indicators. The risk of having an additional smoke-related cancer is substantially higher with these risk factors compared to the

background population. The poor prognosis for patients in this report may also be related to the advanced stage (T3 and T4) of their cancers.

Although the vast majority of the patients (85%) were referred with severe dysphagia, and although nearly half (47%) were unable to swallow at the time of diagnosis, the majority achieved a successful result. As a consequence of severe dysphagia, the patients were in a poor nutritional status (BMI 20) at the time of the diagnosis, and some needed tube feeding during chemotherapy and radiotherapy and prior to surgery. Apart from improving the patients' survival, surgery was performed to increase their quality of life. Three months after surgery, 16 of the 20 patients had regained good-quality swallowing function and were able to ingest solid foods. This result is comparable to results reported in other international studies which have also used jejunal interposition [9, 10].

The limited number of patients in the present study makes it impossible to evaluate the effect of preoperative treatment with combined chemoradiotherapy. However, a metaanalysis of large randomized phase III studies concluded that neoadjuvant concomitant chemoradiation therapy followed by resection is favourable in squamous cell carcinoma of the oesophagus [3].

Many different techniques have been used to achieve a functioning reconstruction of the upper part of the oesophagus: local flaps in combination with split-skin transplants, pedicled external flaps and colon interpositions, gastric pull-ups and free tissue transfers [11–15]. The use of a free jejunal transfer is an accepted method and the preferred choice at many centres. The advantage of the jejunal transfer is owed to its anatomy and physiology. The jejunum has the same tubular shape as the oesophagus and approximately the same diameter and it can be used for long reconstructions [16]. Owing to its large blood supply, jejunal transfer is also appropriate in irradiated areas. The swallowing function may be re-established even sooner owing to the secretory function of the mucosal layer in the oesophageal transfer.

In this study, six patients (30%) were observed to have strictures, while three patients (15%) developed fistulas. Previous studies have reported stricture rates ranging from 4% to 30%, and fistula rates ranging from 2% to 33% [2]. Correlation between prior radiation treatment and development of strictures and/or fistulas has been reported [17]. Our material is too small to confirm or disprove such correlation.

Some centres prefer reconstruction using free fascio-cutaneous flaps such as the radial forearm flap and the anterolateral thigh flap. The most frequent argument in favour of those techniques is the increased morbidity that results from the intraabdominal procedure

and the high risk related to sensitivity of the jejunal flap to ischaemia [18]. No evidence in our material indicates an increased morbidity due to the intraabdominal procedure. Three cases of postoperative arterial ischaemia were seen, and in all three cases the jejunal interposition was saved using reliable monitoring techniques [6].

Reconstruction with jejunal graft interposition is superior to previous techniques in terms of time to oral food intake and length of hospitalization [19]. The hospitalization time in this study was acceptable; mean 24.1 days (range 13-48). In a Danish report from 2001, the average length of hospitalization was 37 days [20]. Likewise, the patients who later died were admitted to hospital during 3.6% (median) of their remaining life, while the patients who remained alive were admitted for 1.2% (median) of their total follow-up time.

CONCLUSION

Reconstruction of the oesophagus with jejunal interposition is a suitable treatment for selected patients with cancer in the upper oesophagus. The five-year survival at our centre is comparable to that reported in other international studies, and the adverse effects were acceptable.

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CONFLICTS OF INTEREST: None

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