

CEM K. PARSAK¹, ULKU TUNCER², EROL KESIKTAS³, TOLGA AKCAM¹, GURHAN SAKMAN¹,
SULEYMAN OZDEMIR², OZGUR TARKAN², ISMAIL O. KARA⁴

Reconstruction of Cervical Esophagus Defects by Free Jejunal Flap After Proximal Esophageal Carcinoma Resections

Rekonstrukcja wad przełyku szyjnego za pomocą wolnego przeszczepu jelitowego po proksymalnej resekcji z powodu raka

¹ Department of General Surgery, Cukurova University Faculty of Medicine, Adana, Turkey

² Department of Otolaryngology, Cukurova University Faculty of Medicine, Adana, Turkey

³ Department of Plastic and Reconstructive Surgery, Cukurova University Faculty of Medicine, Adana, Turkey

⁴ Department of Medical Oncology, Cukurova University Faculty of Medicine, Adana, Turkey

Abstract

Background. Surgical treatment of proximal esophageal defects remains one of the greatest challenges to surgeons.

Objectives. The aim of this study was to evaluate the free jejunal flap surgical technique and the surgical outcomes in patients who underwent it for proximal esophageal carcinoma resections.

Material and Methods. The medical records of nine patients who underwent free jejunal flap reconstruction of the cervical esophagus for proximal esophageal cancer between January 2007 and December 2009 at the Cukurova University Faculty of Medicine, Adana, Turkey, were evaluated retrospectively. The patients' age, gender, symptoms, laboratory findings, diagnostic procedures, stage of disease, pathology, flap viability, length of hospitalization, post-operative ability to swallow, post-operative morbidity, mortality and recurrence were evaluated. The patients were followed up for 11 to 36 months.

Results. Although the free jejunal flap technique is a time-consuming and multi-step procedure, all of the free jejunal flaps survived. All of the patients exhibited good post-operative swallowing ability. One patient developed a salivary fistula. There was only one death, resulting from sepsis caused by late diagnosis of displacement of the jejunostomy tube.

Conclusions. All the patients regained their capacity to swallow, which improved their quality of life. The free jejunal flap procedure offers rapid rehabilitation and improved quality of life. The study involved only a limited number of patients, but confirmed that with the cooperation of the surgical teams, free jejunal flaps can be used successfully on suitable patients requiring laryngopharyngectomy with cervical esophagectomy (*Adv Clin Exp Med* 2011, 20, 6, 729–736).

Key words: esophageal cancer, free jejunal flap, reconstruction, microvascular.

Streszczenie

Wprowadzenie. Chirurgiczne leczenie wad przełyku proksymalnego pozostaje jednym z największych wyzwań dla chirurgów.

Cel pracy. Ocena techniki chirurgicznej z użyciem wolnego płata jelita czczego i wyniku leczenia chirurgicznego u pacjentów, u których wykonano ten zabieg w celu proksymalnej resekcji raka przełyku.

Materiał i metody. Oceniono retrospektywnie dokumentację medyczną 9 pacjentów, u których przeprowadzono rekonstrukcję szyjnej części przełyku wolnym płatem jelita czczego z powodu raka bliższego przełyku od stycznia 2007 do grudnia 2009 r. na Wydziale Lekarskim Uniwersytetu Cukurova, Adana, Turcja. Oceniono wiek pacjentów, płeć, objawy, wyniki badań laboratoryjnych, procedury diagnostyczne, stadium choroby, patologię, żywotność płata, czas pobytu w szpitalu, pooperacyjną zdolność do przełykania, pooperacyjną zachorowalność, śmiertelność i występowanie nawrotów. Pacjenci byli obserwowani przez 11–36 miesięcy.

Wyniki. Chociaż technika używająca wolnych płatów jelita czczego jest czasochłonna i wieloetapowa, wszystkie wolne płaty jelita czczego przeżyły. Wszyscy pacjenci wykazali się dobrą kooperacyjną zdolnością połykania. U jednego pacjenta wystąpiła przetoka ślinowa. Tylko jeden pacjent zmarł z powodu sepsy, która wystąpiła przez późne rozpoznanie przemieszczenia rurki do jejunostomii.

Wnioski. Wszyscy pacjenci odzyskali zdolność przełykania, co poprawiło jakość ich życia. Technika używająca wolnych płatów jelita czczego zapewnia szybką rehabilitację i poprawę jakości życia. W badaniu wzięła udział tylko ograniczona liczba pacjentów, ale autorzy potwierdzili, że przy współpracy zespołów chirurgicznych technika używająca wolnego płata jelita czczego może być z powodzeniem stosowana u odpowiednio dobranych pacjentów wymagających usunięcia krtani i gardła wraz z częścią szyjną przełyku (*Adv Clin Exp Med* 2011, 20, 6, 729–736).

Słowa kluczowe: rak przełyku, wolny płat jelita czczego, rekonstrukcja, mikrokrążenie.

In the literature there are reports of various reconstruction methods being used to achieve safe and functional reconstruction secondary to total pharyngolaryngoesophagectomy [1–5]. Deltopectoral and musculocutaneous flaps are among these reconstruction methods, and are reported to be associated with some disadvantages, including a prolonged operation time, an increased rate of flap necrosis and other documented complications [3–6]. In pharyngoesophageal reconstruction operations with vascular anastomosis, gastrointestinal system continuity is maintained by transplanting a free intestinal flap or by using an intestinal segment with a pedicle [3]. The aim of the free jejunal flap is a single-stage reconstruction with low morbidity and mortality, a short hospital stay and early restoration of swallowing. For many years this procedure was infrequently used due to the low success rate of microvascular anastomosis. However, in 1992 Miller and Lee reported a high success rate for reconstructions with jejunal free flaps [7]. With the advanced applications of microsurgery, almost all difficult defects of the esophagus can be reconstructed [7, 8], and increased experience and improved instrumentation have contributed the popularity of this technique.

Curative treatment of proximal esophageal cancer is a multistep process, involving pre-operative chemoradiotherapy followed by extensive surgery, including laryngectomy and reconstruction of the upper part of the esophagus. The aim of this study was to evaluate the surgical technique, complications and results in a series of nine consecutive patients who underwent pharyngoesophageal resection for proximal esophageal cancer followed by reconstruction with a free jejunal flap.

Material and Methods

The authors retrospectively evaluated the medical records of nine patients (six males, three females) who underwent resection of cancer of the proximal esophagus followed by reconstruction using free jejunal flap interposition between January 2007 and December 2009 in the General

Surgery Department of the Cukurova University Faculty of Medicine, Adana, Turkey. The authors performed all the operations in collaboration with the Otolaryngology (ENT) Clinic and the Plastic and Reconstructive Surgery Clinic. All the patients were operated on by the same surgical team. The charts of all the patients were reviewed retrospectively. Data from these nine cases were evaluated for clinical characteristics, the stage of the disease, pathology, flap viability, length of hospitalization, post-operative ability to swallow and post-operative morbidity and mortality.

The mean age of the patients was 64.9 years (ranging from 58 to 73 years). The male-to-female ratio was 6:3. All the patients were evaluated by means of endoscopy of the upper respiratory and gastrointestinal tract in order to determine the tumor spread and stage, and the diagnosis was confirmed by histological examination of the biopsy tissues. The histopathological diagnosis was

Table 1. Patient and tumor characteristics

Tabela 1. Charakterystyka pacjentów i guzów

Age – years (Wiek – lata)	mean: 64.9; range from 58 to 73
Gender (Płeć)	6 males/3 females
Signs and symptoms (Objawy)	
dysphagia	9 (100%)
weight loss	7 (77%)
vomiting or regurgitation	3 (33%)
cough or hoarseness	2 (22%)
pain	2 (22%)
Pathology (Patologia)	
squamous cell carcinoma	9 (100%)
Tumor stage – TNM (Stopień zaawansowania nowotworu wg klasyfikacji TNM)	
I	3 (33%)
II	2 (22%)
III	4 (44%)
Pre-operative radiation therapy (Radioterapia preoperacyjna)	6 (66%)

squamous cell carcinoma (epidermoid carcinoma) in all cases; the clinical pre-operative staging according to the tumor-node metastasis (TNM) classification system is presented in Table 1. Additionally, the neck and thorax were evaluated with computed tomography, and the whole body with positron emission tomography. The patients' supra-aortic branches were examined with Doppler ultrasonography to assess vascular anastomosis. After hospitalization, the patients' nutritional status was established and a combination of enteral and parenteral nutritional support was started for all the patients.

The Surgical Technique

The operation was started by the ENT team: A total pharyngolaryngectomy with bilateral modified neck dissection was performed on all the patients. Then the general surgery team started its involvement in the operation: A proximal esophagectomy with a negative surgical margin confirmed by intraoperative frozen section was performed. For the free flap, a jejunum segment approximately 15 cm long was resected (from a location 20–30 cm from the Treitz ligament) with an appropriate artery, vein and adequate intestinal arcade, using the transillumination technique and preserving the vascular pedicle of the remaining jejunum (Fig. 1). Just after the complete resection of the tumor, the vascular pedicle of the jejunal segment was excised and the recipient cervical vessels were prepared, following intravenous administration of 1500 IU of heparin sulphate. The proximal 3 cm of the resected segment was divided with bowel wall and mesentery to serve as a monitoring segment. A jejunojejunoanastomosis was performed by end-to-end anastomosis between the proximal and distal jejunum. Finally, the mesenteric window was closed. For early enteral nutrition, a Witzel enterostomy was performed distal to the bowel anastomosis in all patients and the abdomen was closed.

To prevent donor ischemia, the plastic and reconstructive surgical teams immediately began their participation in the operation. First, vascular anastomosis between the main venous branch of the jejunal segment and the vena jugularis interna was performed, using microvascular surgical techniques. Then the main jejunal artery was anastomosed with the arteria carotis externa. Peri-operative Doppler ultrasonography was performed to confirm micro-vascular anastomosis. The viability and peristalsis of the jejunal segment were also carefully observed. After the vascular anastomosis, a 3 cm segment of the proximal jejunum was left attached to the revascularized mesenteric arcade and then externalized through the cervical wound



Fig. 1. Transillumination showing arches on the mesenteric border of the jejunum

Ryc. 1. Transiluminacja ukazująca łuki na granicy krezki jelita czczego

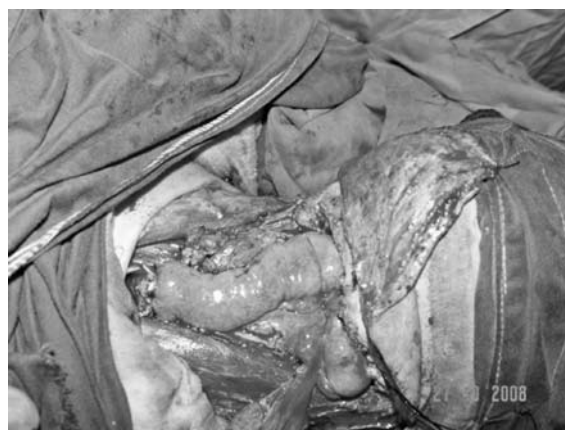


Fig. 2. The completion of free jejunal flap anastomosis to the cervical esophagus. A jejunal monitoring segment will be placed outside the wound

Ryc. 2. Ukończony zespolenie wolnego płata jelita czczego i części szyjnej przełyku. Fragment jelita czczego do monitorowania zostanie umieszczony na zewnątrz rany

to serve as a monitor (Fig. 2). This “monitoring segment” has the same blood supply as the jejunal segment used for reconstruction but is not an integral part of the reconstruction. Enteral anastomosis between the proximal jejunum and the hypopharyngeal remnant of esophageal tissue and between the distal jejunum and distal esophagus was performed by interposing the free isoperistaltic jejunal flap. Both proximal and distal bowel anastomosis was performed in one layer using absorbable polyglactin sutures (Fig. 2). Anticoagulation treatment with subcutaneous low-molecular-weight heparin (enoxaparine sodium) was started in all patients on the first post-operative day and was continued for 15 days.

Urine output was monitored and hematological and biochemical examinations were performed every 24 hours. Post-operative complications were recorded, along with their management. Enteral feeding was started via jejunostomy on the first post-operative day and the amount was gradually increased to the full dose. The jejunal segment used as a monitor was checked every 6 hours, and observation of flap viability lasted for five days (Fig. 3). On the fifth post-operative day, the monitoring segment was excised at the bedside under local anesthesia by ligating and dividing the pedicle at skin level. On the seventh day, the jejunal flap passage was confirmed by fluoroscopy (Fig. 4) and patients were allowed oral intake if the examination results were normal. Oral alimentation was recommenced, first with liquids and then with semi-solids for the first 15 days. From the 15th day, a full range of food was allowed.

The length of hospitalization, mean oral liquid starting time, early complications (in the first 15 days) and late complications (after 15 days) were recorded. The patients were followed up at 1, 6, 12, 18 and 24 months post-operatively in outpatient clinics. Their follow-up included endoscopy when required, evaluation of swallowing and of any changes in weight.

Results

The mean age of the female patients was 64.6 years (range: 61–68 years) and that of male patients was 65.1 years (range: 58–73 years). Of the nine patients, three had no previous treatment, while six had previously had radiotherapy due to local spread of the cancer. The most common complaint at the initial evaluation was dysphagia. All nine patients were treated by the same ENT, reconstructive and general surgery teams. All the patients were treated for epidermoid carcinoma of the hypopharynx with a laryngopharyngectomy and cervical esophagectomy. Tumor-free margins were achieved in all patients, as confirmed by frozen section evaluation, and all the operations were performed without any perioperative complications.

During the early post-operative period, all the patients were managed in intensive-care-unit conditions. There were no flap failures or revisions in the series. There were no complications related to the donor site due to mobilization of the free jejunal transfer. The incidence of the post-operative complications in the series was low. One patient developed a salivary fistula due to an infection in the neck, and recovered with anti-inflammatory treatment and dressing changes. Other post-op-

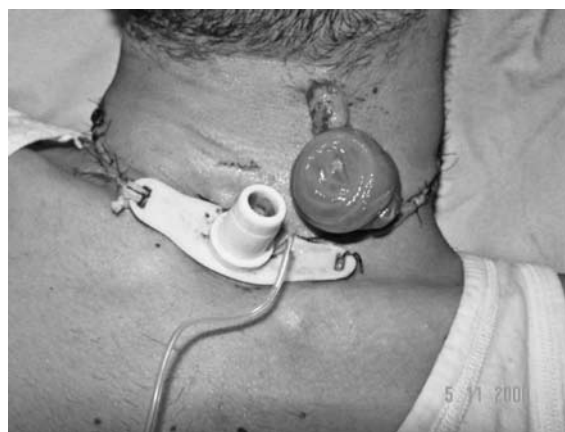


Fig. 3. The monitoring segment can be seen in the lateral aspect of the neck. On the fifth post-operative day, the monitoring segment is excised under local anesthesia at the bedside

Ryc. 3. Segment jelita do monitorowania jest widoczny w części bocznej szyi. W piątym dniu po operacji segment do monitorowania jest usuwany w znieczuleniu miejscowym przy łóżku chorego



Fig. 4. On the seventh day, fluoroscopic examination revealed transit of a contrast medium through the esophagus

Ryc. 4. Siódmego dnia badanie fluoroskopowe wykazało przejście środka kontrastowego przez przełyk

erative medical complications included wound infection in two patients and pneumonia in one patient. All of the complications were managed with conservative treatment. Unfortunately, one of the patients died in the early post-operative period due to peritoneal sepsis secondary to late diagnosis of jejunostomy tube displacement. Because of enteral nutrient leakage into the abdomen, the patient was re-operated to restore jejunal continuity and to insert a new jejunostomy tube. As a result of this complication the patient died seven days after his second operation (Table 2).

The average time period before resumption of oral feeding was 8.7 days after the operation (range:

Table 2. Patients who underwent free jejunal flap reconstruction**Tabela 2.** Pacjenci, u których wykonano rekonstrukcję za pomocą wolnego płata jelita czczego

Patient number, gender (Numer pacjenta, płeć)	Age – years (Wiek – lata)	Radiotherapy (Radioterapia)	Chemotherapy (Chemioterapia)	Complications (Powikłania)	Hospital stay – days (Czas pobytu w szpitalu – dni)	Time to oral liquid – days (Czas, jaki upłynął do przyjmowania pokarmów płynnych – dni)
1, M	58	+	+	–	16	7
2, M	67	–	–	–	15	6
3, F	60	+	+	–	17	8
4, M	73	–	–	pneumonia + wound infection	23	7
5, M	70	+	–	salivary fistula	27	20
6, F	63	+	+	–	16	7
7, M	66	+	+	wound infection	19	8
8, F	62	+	–	–	18	7
9, M	65	–	–	death	22	–

Table 3. Functional evaluation of patients at last follow-up (n = 8)**Tabela 3.** Ocena czynnościowa pacjentów podczas ostatniej obserwacji (n = 8)

Regular diet (Typowa dieta)	
tube feeds	8 (100%)
none	8 (100%)
Dysphagia (Dysfagia)	
none	8 (100%)
Solids (Pokarmy stałe)	
mild	2 (25%)
severe	0
Liquids (Pokarmy płynne)	
mild	2 (25%)
severe	0
Stricture-dilation (Zwężenie, rozszerzenie)	0
Reflux (Refluks)	
none	8 (100%)
mild	0
severe	0

6–20 days). The longest period (20 days) was due to the patient with a salivary fistula. Swallowing was achieved in all patients after their recovery from the procedure. The mean length of hospitalization was 19.2 days (range: 15–27 days, Table 2). The patients were followed up in the outpatient clinic at 1, 6, 12, 18 and 24 months post-operatively. There were no late complications such as strictures (Table 3). For the eight patients for whom follow-up data

are available, the median survival time to the most recent control date is 17.2 months (range: 11–36 months). Local recurrences of esophageal cancer have been detected in two patients

Discussion

The poor prognosis for hypopharyngeal and esophageal cancers have led surgeons to search for extensive surgical operations that maintain the physiological functions of the gastrointestinal system and also entail low morbidity and a short hospital stay. Increased experience and improvement of instrumentation for microvascular operations have contributed to the popularity of free jejunal flaps [4–9]. With technological improvements in microsurgery, long-segment supercharged pedicled jejunal flaps are used for total esophageal reconstructions, and deep inferior epigastric perforator flaps are used for partial reconstruction of the esophagus [10, 11].

Chen and Tang reported that in their experience the best results in reconstructions of small segments of the cervical esophagus might be achieved with advancement of the esophageal wall, when feasible [7]. Their second choice was substitution with another mucosal lining – e.g., a jejunal flap – because it heals the best. If the surgeon is not confident and not experienced with jejunal flaps, a musculocutaneous flap can be used. They ranked free skin flaps, such as free forearm flaps, as the last choice.

At the current authors' institution, the free jejunal flap technique is used for the reconstruction of the proximal esophagus with the cooperation of the plastic and reconstructive surgery clinics. The revascularization success rate was 100%, which confirms the clinical usefulness and reliability of the procedure. This high rate of flap viability can be explained by the fact that the surgical team performs vascular anastomosis before enteral anastomosis and uses a monitoring segment for flap viability. As far as the authors know, only one other free jejunal flap series (involving 14 patients) has been reported in the literature from Turkey [12]. Therefore the current series is important to demonstrate the feasibility of this surgical technique in the context of this country's standards. The free jejunal flap technique ensures an excellent blood supply and one-stage reconstruction even in irradiated patients. In the series described, despite a high rate of pre-operative radiotherapy, there was no anastomotic leakage except one salivary fistula, and resumption of oral alimentation was possible in all patients. After surgery, obvious weight gains were recorded during the patient follow-ups. Concerning the functional results, good swallowing has been preserved in all the patients, none of whom has had to change from a normal diet during the follow-up period, and no problems with gastric reflux have been noted.

Colon transfer is not a preferred technique for the reconstruction of defects, due to the high risk of post-anastomotic leakage in the donor area. The ileum is narrow and its vascular structures are short. The jejunum is readily available, is generally free of intrinsic disease; it closely approximates the diameter of the esophagus, and might maintain intrinsic peristalsis after reconstruction. The jejunum, especially the distal part of the duodeno-jejunal junction, is a very good donor because it has a suitable vascular anatomy for the hypopharyngeal area [13]. It has been emphasized in the literature that jejunal free flaps, along with their vascular pedicles, have available anatomic-physiologic characteristics for the reconstruction of hypopharynx or cervical esophagus. The swallowing function may be re-established even earlier than with other flaps, owing to the secreting function of the mucosal layer [13]. The possibility of completing the surgery in one sequence and reconstructing large defects, as well as early bowel movement are significant advantages of this procedure; visceral reconstruction without thoracic entry is a relative advantage of this procedure [14]. In addition to these advantages, as the current case series confirms, this technique can be used in patients who have undergone neoadjuvant and adjuvant radiotherapy without any complications [4, 14, 15]. When the early- and late-onset

complications of the abdominal procedure are evaluated, the rates of anastomotic leakage, enteral obstruction, anastomotic stenosis and/or intra-abdominal abscess are very low [3].

The jejunal free flap technique involves specific complications related to the abdominal donor area, microvascular anastomosis or enteric anastomosis. Major complications of this procedure include flap insufficiency and bowel intussusceptions [5, 6]. In free flap reconstruction, the important point is the identification of vascular structures suitable for anastomosis. Depending on the patient's vascular structures, the common carotid artery, transverse cervical artery, facial artery, lingual artery, superior thyroid artery, inferior thyroid artery, ascendant cervical artery, internal thoracic artery or brachiocephalic artery might be used. The external jugular vein, internal jugular vein and facial vein are available for venous anastomosis [7, 9]. The current authors preferred the external carotid artery and jugular vein for microvascular anastomosis in the operations described.

For the survival of free jejunal flaps, it is crucial to maintain the patency of the anatomized vessels. To ensure this, the jejunal flap should be frequently monitored post-operatively by fiber laryngoscope, Doppler ultrasonography or direct visualization in order to detect any disruption of the blood supply as early as possible. In the series described in this paper, the authors preferred to use a monitoring technique with a vascularized 3 cm jejunal segment externalized through the cervical wound to observe flap viability, similar to the technique described by Cho et al. [16] and Dionyssopoulos et al. [17].

Microvascular complications have decreased in the last 20 years [18]. A retrospective review by Disa et al. of 90 consecutive free jejunum transfers "demonstrated a 98% flap success rate. The mean hospital stay was 19 days. Nearly 65% of patients resumed an unrestricted diet and 88% maintained adequate peroral nutrition" [18]. Although the current study involves a limited number of cases, revascularization was successful in all of the reconstructions. In the current authors' opinion, performing microvascular anastomosis before enteric anastomosis ensures good perfusion of the free flap and can provide early revision of vascular anastomosis in case of flap ischemia or congestion.

Another of the principle factors affecting the outcome of reconstruction is curative resection of enough of the tumor while removing as little normal tissue as possible [19]. Therefore, like Zhao et al., the current authors provided appropriate resection margins in three dimensions during the surgery; tumor-free margins were further confirmed by frozen section during the operation, followed by appropriate reconstruction.

The most common complications of free jejunal reconstruction are wound healing disorders, hemorrhage, necrosis, pulmonary infections and fistula [19]. Salivary fistulae and strictures are another risk in esophageal operations [14]. A salivary fistula occurred in one of the patients in the current study and was successfully managed conservatively. In the authors' opinion, this salivary fistula occurrence might have been associated with the condition of the microvascular anastomosis rather than problems arising from the enteric anastomosis technique. The salivary fistula occurred in a 70-year-old patient with atherosclerotic cardiovascular disease. This demonstrates that pre-operative evaluation of co-morbid diseases is important to prevent complications.

The mean hospitalization time in the current study was acceptable: 19.2 days (range: 15–27 days), the longest stay being the patient with a salivary fistula. In a Danish report from 2010, the average length of hospitalization was 24.1 days [20].

A potential limitation of this study is the small number of cases. However, as noted earlier, when considered along with those from the other clinical study with similar case numbers from Turkey, the combined results may provide a good picture of the procedure's safety, utility and feasibility in this country [12].

The optimum reconstruction method should maintain alimentary comfort with low morbidity

and mortality [3]. Complications observed after surgery mainly affect the duration of hospitalization, the initiation of post-operative therapy (e.g. radiotherapy), nutritional status, quality of life and the cost of hospitalization. With advanced techniques and improved surgical equipment, the free jejunal flap has become almost a standard technique in the reconstruction of hypopharyngeal and cervical esophageal defects. However, free jejunal flap reconstruction remains a procedure that requires a surgeon and/or surgical team skilled at microvascular techniques.

In this study, a high success rate was achieved with a low incidence of complications in the reconstruction of the proximal esophagus. Collaboration among different clinics has made it possible to use this technique, but it remains a technically demanding operation best suited for patients with defects in the cervical esophagus due to proximal cancers. Gastric tube interposition or a supercharged pedicled jejunal flap may be more appropriate for reconstructing the hypopharynx and cervical esophagus, when the resection extends below the thoracic inlet [21]. In the author's opinion, based on a limited number of cases, the free jejunal flap technique can be used safely and successfully for the reconstruction of the hypopharynx or cervical esophagus in centers where cooperation among different surgical teams is possible.

References

- [1] **Suh JD, Sercarz JA, Abemayor E, Calcaterra TC, Rawnsley JD, Alam D, Blackwell KE:** Analysis of outcome and complications in 400 cases of microvascular head and neck reconstruction. *Arch Otolaryngol Head Neck Surg* 2004, 130, 962–966.
- [2] **Nakatsuka T, Harii K, Asato H, Takushima A, Ebihara S, Kimata Y, Yamada A, Ueda K, Ichioka S:** Analytic review of 2372 free flap transfers for head and neck reconstruction following cancer resection. *J Reconstr Microsurg* 2003, 19, 363–368.
- [3] **Hanson RP, Chow TK, Feehan E, Eadie PA, Timon CT, Keogh S:** Analysis of functional results and quality of life following free jejunal flaps for reconstruction after upper aerodigestive neoplastic resection: the St James's experience. *J Plast Reconstr Aesthet Surg* 2007, 60, 577–582.
- [4] **Ikeguchi M, Miyake T, Matsunaga T, Yamamoto M, Fukumoto Y, Yamada Y, Fukuda K, Saito H, Tatebe S, Tsujitani S:** Free Jejunal Graft Reconstruction After Resection of Neck Cancers: Our Surgical Technique. *Surg Today* 2009, 39, 925–928.
- [5] **Wong CH, Wei FC:** Microsurgical free flap in head and neck reconstruction. *Head Neck* 2010, 32, 1236–1245.
- [6] **Clark JR, Gilbert R, Irish J, Brown D, Neligan P, Gullane PJ:** Morbidity after flap reconstruction of hypopharyngeal defects. *Laryngoscope* 2006, 116, 173–181.
- [7] **Chen HC, Tang YB:** Microsurgical reconstruction of the esophagus. *Semin Surg Oncol* 2000, 19, 235–245.
- [8] **Archibald S, Young JE, Thoma A:** Pharyngo-cervical esophageal reconstruction. *Clin Plast Surg* 2005, 32, 339–346.
- [9] **Lam LK, Wei WI, Chan VS, Ng RW, Ho WK:** Microvascular free tissue reconstruction following extirpation of head and neck tumour: experience towards an optimal outcome. *J Laryngol Otol* 2002, 116, 929–936.
- [10] **Ascioti AJ, Hofstetter WL, Miller MJ, Rice DC, Swisher SG, Vaporciyan AA, Roth JA, Putnam JB, Smythe WR, Feig BW, Mansfield PF, Pisters PW, Torres MT, Walsh GL:** Long-segment, supercharged, pedicled jejunal flap for total esophageal reconstruction. *J Thorac Cardiovasc Surg* 2005, 130, 1391–1398.
- [11] **Louie O, Dickinson B, Granzow J, Boyd JB:** Reconstruction of total laryngopharyngectomy defects with deep inferior epigastric perforator flaps. *J Reconstr Microsurg* 2009, 25, 555–558.
- [12] **Ferahkose Z, Bedirli A, Kerem M, Azili C, Sozuer EM, Akin M:** Comparison of free jejunal graft with gastric pull-up reconstruction after resection of hypopharyngeal and cervical esophageal carcinoma. *Dis Esophagus* 2008, 21, 340–345.

- [13] **Chen HC, Rampazzo A, Gharb BB, Wong MT, Mardini S, Chen HY, Salgado CJ:** Motility differences in free colon and free jejunum flaps for reconstruction of the cervical esophagus. *Plast Reconstr Surg* 2008, 122, 1410–1416.
- [14] **Disa JJ, Pusic AL, Mehrara BJ:** Reconstruction of the hypopharynx with the free jejunum transfer. *J Surg Oncol* 2006, 94, 466–470.
- [15] **Ott K, Lordick F, Molls M, Bartels H, Biemer E, Siewert JR:** Limited resection and free jejunal graft interposition for squamous cell carcinoma of the cervical oesophagus. *Br J Surg* 2009, 96, 258–266.
- [16] **Cho BC, Shin DP, Byun JS, Park JW, Baik BS:** Monitoring flap for buried free tissue transfer: its importance and reliability. *Plast Reconstr Surg* 2002, 110, 1249–1258.
- [17] **Dionyssopoulos A, Harris PG, Karagergou E, Ferraro P, Guertin L, Danino AM:** Monitoring of free jejunal transfer. *J Plast Reconstr Aesthet Surg* 2010, 63, e209–210.
- [18] **Disa JJ, Pusic AL, Hidalgo DA, Cordeiro PG:** Microvascular reconstruction of the hypopharynx: defect classification, treatment algorithm, and functional outcome based on 165 consecutive cases. *Plast Reconstr Surg* 2003, 111, 652–660.
- [19] **Zhao D, Gao X, Guan L, Su W, Gao J, Liu C, Luo X, Li X:** Free jejunal graft for reconstruction of defects in the hypopharynx and cervical esophagus following the cancer resections. *J Gastrointest Surg* 2009, 13, 1368–1372.
- [20] **Wallentin RS, Sorensen HB, Bundgaard T, Pahle E, Nordmark M, Pilegaard H:** Reconstruction using free jejunal transfer after resection of cancer of the upper oesophagus. *Dan Med Bul* 2010, 57, 1–5.
- [21] **Triboulet JP, Mariette C, Chevalier D, Amrouni H:** Surgical management of carcinoma of the hypopharynx and cervical esophagus: analysis of 209 cases. *Arch Surg* 2001, 136, 1164–1170.

Address for correspondence:

Cem K. Parsak
Çukurova Üniversitesi Tıp Fakültesi, Genel Cerrahi Anabilim Dalı
Balcalı, Adana
Turkey
Tel.: 0 322 338 60 60/3171
E-mail: cparsak@yahoo.com

Conflict of interest: None declared

Received: 6.01.2011

Revised: 8.02.2011

Accepted: 7.12.2011