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Intra-Arterial Infusion Catheters with Implantable Injection Chambers in Maxillo-Facial Oncology

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Summary

An intra-arterial chemotherapy procedure in patients with malignant tumours in the oral and maxillo-facial region which, from the vascular point of view, can be dependent on the external carotid artery and/or its branches is presented. Particularly for the prevention of catheter infection, obstruction, etc., a subcutaneous pouch, connected to the infusion catheter, is implanted subcutaneously in the submastoid region.

Key-Words

Maxillo-facial tumour – Intra-arterial chemotherapy – Implantation of catheter

Introduction

Regional intra-arterial chemotherapy in the treatment of maxillo-facial tumours is used with curative intent in combined chemotherapy and radiotherapy (*Kreidler* and *Petzel*, 1983; *Szepezi* et al., 1984; *Goepfert* et al., 1973), in palliative treatment schedules (*Sullivan* et al., 1961; *Freckman*, 1972; *Donegan* and *Harris*, 1973), or in induction chemotherapy protocols to reduce the size, extent and viability of advanced tumours (*Gollin* and *Johnson*, 1971; *Bilder* and *Hornova*, 1970; *Snow* and *Sindram*, 1973; *Richard* et al., 1974; *Nervi* et al., 1978; *Curioni* and *Quadu*, 1978; *Szabo* and *Kovacs*, 1979; *Molinari*, 1985).
Problems with catheter infections are frequently seen during long term local intra-arterial chemotherapy regimes (*Szabo* and *Kovacs*, 1979), and are mostly due to contamination of the infusion system used. We therefore advocate intra-arterial infusion with an implantable intra-arterial infusion catheter (Implantofix®, Braun, Melsungen). An innovation in the use of these catheters in the maxillo-facial region is presented.

Technique

The implantation technique is usually performed under general anaesthesia.
The kind of intubation depends on the site and/or extent of the tumour. When possible, we prefer nasotracheal intubation with a pericranial fixation of the tube (*Hernández Altemir*, 1986), leaving the mouth, face, neck and temporo-mastoid regions exposed on both sides (Fig. 1) (in the event of bilateral catheterization).
In the majority of cases we used a retrograde cannulation technique through the parietal branch of the superficial temporal artery. If the external carotid artery could not be catheterized via the superficial temporal artery a retrograde cannulation technique via the facial temporal artery was used. Three incisions are used, are in the pre-auricular, the second in the retroauricular and the third in the submastoid region (Figs. 2 and 3).
Depending on the site and size of the tumour, the tip of the catheter is placed in the external carotid artery just caudal to the branches perfusing the tumour area.
The insertion of the catheter tip into the external carotid artery, the path of the catheter over the temporal surface around the ear down to the mastoid region, and the insertion of the implantable drug injection chamber at the end of the catheter are carried out before the actual catheterization procedure. The dissection of the superficial temporal artery is made through a preauricular incision (*Kreidler* and *Petzel*, 1983; *Bilder* and *Hornova*, 1970) (Fig. 1). This

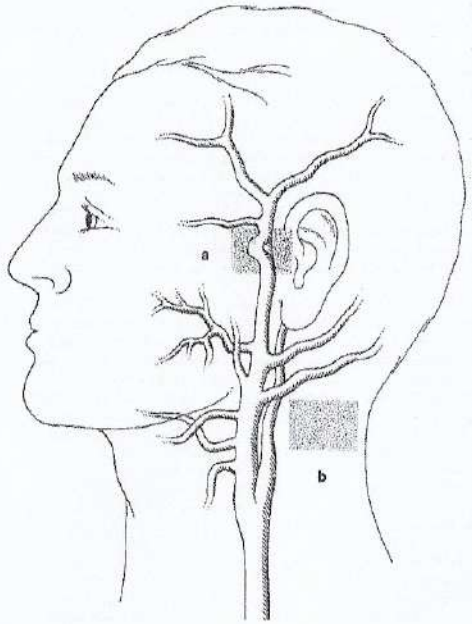

Fig. 1 Perfusion area of the A. carotis externa.
a) The greatest curvature of the vessel is found in the sub-zygomatic region.
b) Region of the subcutaneous pouch for the implantable injection chamber.

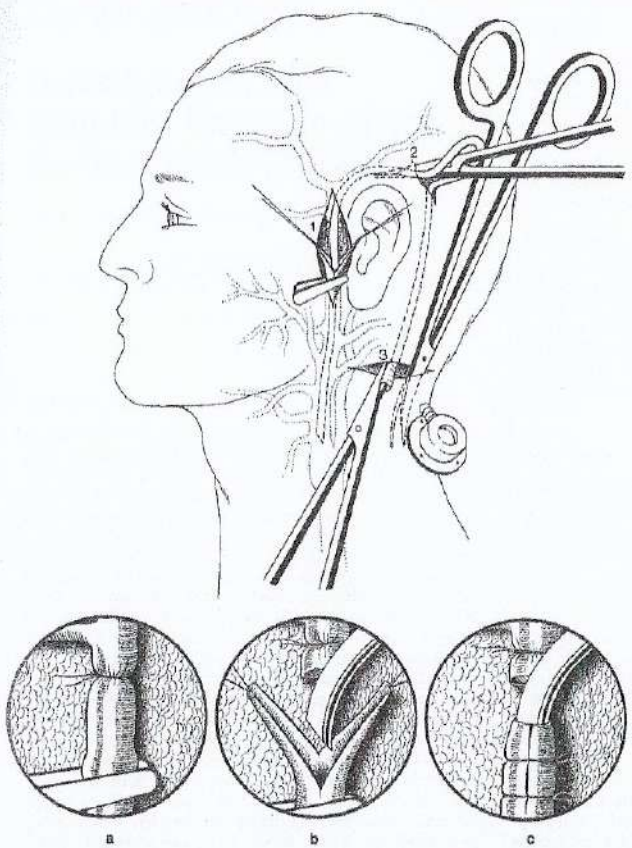

Fig. 2
1 Pre-auricular incision.
2 Retro-auricular incision.
3 Submastoid incision.
a Ligation/clamping of the superficial temporal artery and the longitudinal incision in between.
b Stretching of the artery between ligatures.
c Ligatures round the catheter and artery after checking for correct positioning.

artery usually lies in front of or under the accompanying vein and auriculotemporal nerve, which can be preserved in the majority of cases.
The artery must be freed as far caudally as possible because the greatest curvature of the vessel is found in the subzygomatic region. After ligating collateral vessels, elevation of the superficial temporal artery is simple and the chance of perforation by the catheter in the sub-zygomatic area is minimized.
The superficial temporal artery is ligated cranial to the preauricular incision (Fig. 2, a) and clamped caudally as atraumatically as possible.
Through a 1 cm. longitudinal incision (Fig. 2 a), sutures are passed through and knotted. After cutting the vessel above the knots, the caudal part of the artery can be stretched between ligatures (Fig. 2 a, b), and the bevelled catheter tip can easily be introduced into the vessel, although advancement of the catheter is not always easy because of anatomical variations (*Snow*, 1966). The catheter and the implantable drug injection chamber are flushed with a heparinized saline solution before the catheterization procedure.
The correct position of the tip is checked by disulphine blue injection into the injection chamber (*Kreidler* and *Petzel*, 1983). After control of the correct catheter tip position by disulphine blue staining of the target area, two ligatures are placed below the entry side of the catheter into the cannulated vessel. The catheter is fixed to the temporal fascia by a ligature.
Via a retro-auricular incision, a supra-auricular tunnel is dissected over the temporal fascia to the pre-auricular region (Fig. 2). A retro-auricular tunnel to the mastoid region is created through the same incision.
The drug injection chamber is temporarily removed from the distal part of the catheter, and the catheter can then be pulled through the upper and lower tunnels with a curved haemostat. Using blunt dissection, a subcutaneous pouch is prepared in a cervico-lateral direction (Fig. 2). The implantable drug injection chamber is fixed over the sterno-cleido-mastoid muscle.
During suturing, attention must be paid to the position of the catheter in order to avoid kinks or perforation with the suture needle.

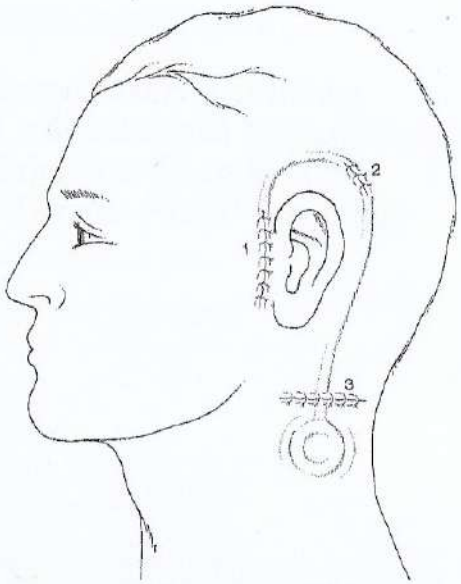

Fig. 3 Preauricular subcutaneous course of the catheter, and the tunnels behind the ear to the subcutaneous pouch for the drug infusion chamber.

The procedure can be done bilaterally in the same session if the tumour crosses the midline.
In our department we start with the chemotherapy schedule 5 days after the cannulation, although some authors (*Kreidler* and *Petzel*, 1983) start the day after the cannulation procedure.
It must be stressed that the implantable intra-arterial infusion catheters are suitable not only for intra-arterial "pulse" administration of cytostatic agents, but also for "intermittent continuous" intra-arterial infusion. In our department we use a perfusor for the administration of the drugs.

Conclusions

Catheterization of the external carotid artery has been used by many authors since *Sullivan* et al. (1953) introduced the technique, and is now a common procedure.
In head and neck oncology, the use of intra-arterial infusion catheters with implantable injection chambers is an improvement, reducing the infection rate associated with the catheter, which always necessitates its removal and leads to delay of the therapy schedules. The technique improves patient comfort and facilitates intra-arterial chemotherapy.

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Investigations into Shoulder Function after Radical Neck Dissection

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Summary

In order to determine shoulder function after radical neck dissection, and to evaluate the outcome of postoperative physical treatment, 43 patients were investigated 10 days up to 1 month after this procedure. Shoulder function was judged by means of (a) clinical investigation of the shoulder girdle and by (b) electromyographic testing of the trapezius muscle. Our results demonstrated a correlation between the extent of atrophy and clinical parameters such as abduction and lateral displacement of the scapula. Electromyography revealed damage present mainly in the descending part of the trapezius, while in the majority of patients the ascending part was only slightly damaged or normal. Electromyography proved a valuable tool for the determination of the clinical state after neck dissection. There was also evidence supporting the efficacy of physical therapy in case of irreversible shoulder disability.

Key-Words

Radical neck dissection – Shoulder function – Physical diagnosis and therapy

Indtroduction

In the head and neck region, cancer surgery is characterized by the coincidence of manifold medical and ethical problems; this is due to the fact that a life-threatening disease has to be treated in a region of the body that is not only most exposed but also a centre of fundamental physiological functions as well as of essential, individual and aesthetic characteristics. Despite intensive studies performed in recent years, in terms of prognosis there has been no substantial improvement for these patients; this led to a more critical discussion of tumour surgery with regard to both indications and results. Special emphasis was laid on the problem of avoiding postoperative, aesthetic-functional impairments (*Harrison*, 1985), comparing functional-surgical concepts – supported by combination therapy (surgery combined with radio- and/or chemotherapy) – to radical surgery, as e. g. in lymph node surgery of the neck ("radical neck dissection – RND" vs. "modified neck dissection – MND" combined with postoperative radiotherapy in "N1–N3 neck", elective neck dissection vs. elective radiotherapy in "N0 neck") (*Schuller*, 1983, *Wetmore* and *Suen*, 1984; *Byers* and *Ballantyne*, 1985). Moreover, measures of reconstructive surgery aiming at the re-establishment of impaired abilities of speaking (*Singer* et al., 1984; *Ehrenberger* et al., 1985), swallowing and chewing (*Lawson* and *Biller*, 1982; *Conley* et al., 1982; *Bakamijan*, 1985), immunobiological, nutritional-physiological (*Bassett* and *Dobie*, 1983; *Wolf*, 1984), aesthetic aspects as well as the social reintegration of these patients are considered extremly relevant (*Wenger*, 1985). The standard method of radical surgical removal of lymph nodes in the neck was introduced by *Crile* in 1906. The most obvious impairment caused by this method is postoperative reduction of shoulder mobility, due to resection of the XI Nerve, and painful stiffness, occasionally even turning into a "cervicobrachial syndrome". Other consequences of this method are those due to resection of the submandibular gland, the lower pole of parotid, sternocleido-mastoid muscle, int. jugular vene; moreover, impairments of peripheral nerves (VII, IX, XII, cervical plexus, P. symp. cerv.) inducing dysfunctions of mouth-angle innervation (N. marg. mandib. – ⅔ of cases), disturbances of taste sensitivity of the posterior pharyngeal part; additionally, Horner-complex due to resection of symp. nervous tissue in case of scarification of the carotid artery (in up to ⅓ of cases each), pareses of the phrenic nerve with elevation of the diaphragm (10 %) or considerable loss of sensitivity in the extended region of shoulder, neck, thorax (*Swift*, 1970).
In order to avoid reduction of shoulder function some surgeons used to preserve XI N. in the case of radical neck dissection; another approach is the "modified" or "functional" neck dissection (*Bocca* and *Pignataro*, 1967), based upon many investigations into special indications and applied particularly in the anglo-american area in the past few decades (*Wetmore* and *Suen*, 1984). Moreover, there were reports of successes in one-sided reconstruction of the accessory nerve with free nerve transplants following radical lymph node dissection in the neck (*Anderson* and *Flower*, 1969; *Sikken* and *Höltje*, 1980). Recently, physical therapy with the objective of shoulder rehabilitation after radical neck dissection is gaining increasing importance (*Saunders*, 1985).
The goal of the present study was to measure postoperative shoulder dysfunction clinically and electro-diagnostically after radical neck dissection; the parameters obtained should provide a tool for evaluating both the success of postoperative physical therapy of the impaired shoulder and/or the effect of free nerve grafts in a subsequent study.

Material and Methods

Patients

In an initial investigation 43 patients were tested. In all of them radical neck dissection was performed in association with the removal of the primary tumour in the head-neck