Neck Dissection Alternatives

R. M. Tiwari,

Dept. of Ear, Nose, Throat and Head & Neck Surgery
University Hospital VU, Amsterdam, The Netherlands

INTRODUCTION

One of the features of head and neck cancer is the fact that it involves organs whose dysfunction is easily noticeable. With the exception of certain specific areas such as the vocal cords, the rest of this anatomical region is richly supplied with lymphatics, vessels and nerves. Spread of malignant tumours originating in this region to the regional lymph nodes is therefore not uncommon. The actual incidence of lymph node metastases may vary slightly with the different region or subregion affected and this may vary in different parts of the globe; (Ali et al, 1985 Shah, 1990). The prognosis of a given stage of primary tumour at any particular site in the Head and Neck becomes almost 50% worse in the presence of lymph node metastases.

To the physician responsible for the treatment, it is important to know whether to treat the neck or not and what kind of therapy is indicated. An attempt has been made in this paper to answer these questions and to provide the reader with an up-to-date information on the subject to diagnosis, treatment and possible future developments.

CURRENT CONCEPTS IN DIAGNOSIS OF CERVICAL NODAL METASTASES

Neck nodes have been traditionally assessed by palpation for nearly a century. Although the competence of an astute clinician may have a high degree of accuracy in palpating a suspicious node, it is common knowledge that this method is far from accurate (Sako et al, 1964). In the event of a nodal clearance being carried out for a negative neck the patient is left with a permanent

morbidity the degree of which may vary from slight to severe. Besides, individual variations amongst clinicians make an accurate assessment difficult. A normal lymph node may vary from 0.5 to 2 cm in size. In the hands of most experts palpation at best offers 70% accuracy of diagnosis. For this reason alternative methods have been sought for.

The advent of CT-scans and its rôle in the delineation of primary tumours of the head and neck has been extended to the assessment of metastatic cervical lymph nodes and this technique is currently universally employed (Stevens et al, 1985; Friedman et al, 1984). The accuracy of diagnosis with this technique ranges from 72 to 92.5% in the literature. The criteria of malignancy in a lymph node on CT scanning are the minimal diameter in the axial plane and the presence of hypodensity. A minimal diameter of 10 mm in most sites and 11 mm at the subdiaphragmatic level is considered pathognomic. (Van den Brekel et al, 1990). Hypodensity in the centre of the lymph node is suggestive of necrosis and fatty metaplasia and is again considered a sign of metastasis.

The advent of magnetic resonance imaging (MRI) has improved the ability of radiological diagnosis. Recent studies show that axial T1 weighted Spin Echo (SE) images combined with T2 weighted gradient refocussed echo (GE) images reliably demonstrate lymph nodes (Van den Brekel et al, 1991).

Gadolinium-DTPA enhanced T1 weighted GE images reveal tumour necrosis in lymph nodes. Although more accurate, MRI is relatively more

expensive. Ultrasonography (US) has been used in the detection of cysts and tumours in the abdominal cavity for some time and its use has been extended to the diagnosis of cervical nodal metastases (Baatenburg de Jong et al, 1988). It is an inexpensive diagnostic tool and in the hands of an experienced observer can provide valuable information. Nodes smaller than 1 cm can be detected. When combined with fine needle aspiration (USFNAC), it can be of considerable value. The experience and precision of the examination can provide reasonable accurate information with minimal investment of time and at low cost.

In a comparison of various diagnostic methods Van den Brekel found USFNAC to be most accurate (Van den Brekel, 1992). In an analysis of 523 neck dissections Leemans et al found that a third of the neck dissections contained no positive nodes (Leemans et al, 1990). These neck dissections were however performed between the period 1973-1986 before the modern diagnostic tools were employed. The increased precision of diagnosis with above mentioned methodology especially USFNAC is therefore likely to offer a possibility to reduce the number of elective neck dissections.

THE N 'O' NECK

For several decades clinicians have based the indication for elective neck dissection on the incidence of false negative or occult nodes in the neck. Several studies from different centres have been published (Ali et al, 1985; Shah et al, 1990; Candela et al, 1990; Byers et al, 1988). In principle this incidence is based upon the density of lymphatics in any given site, the T-stage of the primary tumour and its histopathology. Thus squamous cell carcinoma of the pyriform sinus has nearly 10 times greater propensity for occult metastases than similar stage of carcinoma of the vocal cord. Similarly an undifferentiated carcinoma has an increased incidence (45%) of false negative nodes. It has therefore been a sound practice to perform a neck dissection for instance in an undifferentiated carcinoma of the parotid gland.

It is argued that patients at risk could be just followed up and neck dissection performed if and when nodes do appear. This policy should be weighed against the fact that once occult metastasis becomes manifest, the chance of distant metastasis is increased (Leemans et al, 1993).

The salivary glands form a special group in this respect. It is only recently that the histopathological classification of these tumours has been standardised. This classification of World Health Organisation described 17 different histopathological types of carcinomas originating in the salivary glands. Much of the literature on this subject was contributed by few large series from Conley, Enroth and others. Neck dissection is recommended in undifferentiated carcinoma, squamous cell carcinoma, high grade mucoepidermoid carcinoma, carcinoma in a pleomorphic adenoma and carcinoma originating in the deep lobe of the parotid gland. In addition a neck dissection is advisable whenever the neck is entered for the excision of a primary tumour, for instance when a cheek flap has to be raised for the excision of a lesion located on the retromolar trigone. For similar reasons excision for carcinomas of the submandibular or sublingual salivary glands should be designed to include a neck dissection.

Debate continues as to whether a N'O' neck should not be treated with radiotherapy and the patient spared the morbidity of neck dissection. It is usual to include the area of lymphatic drainage in general, when a primary tumour is treated with radiotherapy. As to what level of lymph nodes are included in the radiation field depends to a large extent on the location and stage of the primary tumour.

There is some debate as to what levels of neck nodes should be cleared if a neck dissection is performed. It is well documented that the lymph nodes of the posterior triangle are involved in a small number of cases in carcinomas of the upper aerodigestive tract (Skolnik et al, 1976a; Candel

et al, 1990). It is therefore argued that clearance of levels I to III is adequate for lesions of the oral cavity and oropharynx through a supraomohyoid dissection (Medina and Byers, 1989). This strategy is however questionable. Spiro et al reported a failure rate of 29% in N+ necks treated with supraomohyoid dissection in spite of postoperative radiotherapy (Spiro et al, 1988). Tiwari, in a review of 44 supraomohyoid dissections in 31 patients with N+ necks reported that 3 patients (10%) died of disease within two years in spite of postoperative radiotherapy (Steiner and Hommerich, 1993). Besides, there seems to be considerable individual variations in the execution of this technique.

While the inferior limit of the procedure at the level where the omohyoid tendon crosses the internal jugular vein is well defined, the posterior limit of dissection is not. Most surgeons arbitrarily use the cervical plexus as the posterior limit of dissection. Some surgeons extend the dissection into the upper most area deep to the sternomastoid in the posterior triangle and use the term expanded supraomohyoid dissection. The posterior belly of digastric marks the upper limit of the dissection. From then on the dissection is carried out medially to include the submandibular and submental areas (Level I). The procedure demands surgical expertise. It is generally agreed that supraomohyoid dissection serves as a good staging procedure. The specimen can be subjected to frozen section if any doubt exists and in the presence of a positive node the dissection converted to include all other levels.

The arterial supply to the sternomastoid muscle from the superior thyroid and the descending branch of the occipital arteries is inadvertently damaged in this procedure leading to delayed muscle atrophy and the argument that the sternomastoid muscle is preserved is therefore not entirely relevant. A group of nodes which are not addressed in any neck dissection are the retropharyngeal lymph nodes. These nodes are located in a vertical chain over the transverse processes of the cervical vertebrae and may be

the first station of lymph drainage in lesions of the lateral and posterior pharyngeal walls, the soft palate and the base of tongue. These nodes are clinically, seldom detectable, but are well visualised on CT-scans and MRI. They are seldom reported upon by the radiologists and indeed few surgeons are aware of their existence. Recurrence of disease in these nodes present clinically as a fullness behind the ascending ramus of the mandible and a retropharyngeal swelling may be visible. It is often painful. A CT-scan reveals a mass usually at the level of the transverse process of atlas. Ballantyne drew attention to these nodes several years ago (Ballantyne, 1976). Krespi and Sisson described a technique for dissection of the skull base region (Krespi and Sission, 1982). It is good policy during surgery for lesions of the oro-hypopharynx to palpate the posterior pharyngeal wall and lift it and if necessary to dissect these nodes and include them in the dissection.

THE N + NECK

In the presence of established cervical nodal metastases a neck dissection may be indicated unless a decision has been taken to treat both the primary tumour and the neck node with radiotherapy. Due to the emergence of selective and modified dissections and the introduction of new terms, it is not surprising that the young clinician is sometimes confounded. The various types of dissection of the neck can be broadly classified into three main groups.

The first group called Comprehensive and comprising of the classical radical neck dissection with its modifications in form of preservation of the jugular vein and/or accessory nerves has been in vogue for several decades.

The second group is called Functional. Its concept was put forward by Suarez and it was popularised by Bocca in the sixties especially in relation to supraglottic carcinoma (Suarez, 1963; Bocca and Pignataro, 1967). In this procedure the accessory nerve, the internal jugular vein as well as the sternomastoid muscle are preserved, but all triangles of the neck are dissection.

The third group is the group of so called Selective dissections. The concept of selective dissections is based on the principle to dissect the levels of lymph nodes that are most at risk. Various types of selective dissections are described depending upon the site of the primary tumour.

COMPREHENSIVE NECK DISSECTIONS

Neck dissection was practised in the early part of this century since the description of its technique by Crile of 1906 (Crile, 1906). With the advent of radiotherapy two decades later, this latter method of treatment became more popular. Soon it became clear that radiotherapy was unable to control lymph node metastases and the long term results were dismal. In the early forties, Martin reinstated radical neck dissection and introduced the concept of en bloc resection of the primary tumour (Martin, 1941).

Advances in general anaesthetics, blood transfusion and the advent of antibiotics made surgery relatively safer and the rate of complications was reduced. For nearly a quarter of a century radical neck dissection was practised without any change. The morbidity of the procedure was tolerated by the patients and accepted by the medical profession. The crippling effect of the procedure due to the loss of the accessory nerve led to the concept of its preservation (Skolnik et al, 1976b; Poy and Beahrs, 1969). The stress on early and continued physiotherapy improved the clinical results. Today, preservation of the accessory nerve is performed in all neck dissections unless it is oncologically not safe to do so.

The technique of radical neck dissection is well described in the literature. Several skin incisions are described. The one most frequently used is the 'Y' incision which combines a suprahyoid incision with a vertically placed 'lazy S' right angle to it. In irradiated neck and/or if the internal jugular vein is preserved the author prefers a modified McFee incision. Basically there are two variations in the technique of radical neck dissection. The first is the technique originally

described by Crile. In this technique the internal jugular vein is first ligated caudally in the supraclavicular area and the dissection carried cranially. This author begins the dissection by identifying the marginal branch of the facial nerve about 2 cm anterior to the angle of the mandible superficial to the facial vein, by making a deliberate opening in the deep fascia and identifying the facial vein. The nerve is dissected posteriorly through the parotid and the lower pole is freed after ligating the retromandibular vein. This brings one to the anterior border of the sternomastoid muscle at its most cranial and anterior point. The accessory nerve is identified along the posterior border of the sternomastoid muscle, 1.5 cm cranial to the exit of the greater auricular nerve, by creating an opening in the deep fascia. The fascia is cut superficial to the nerve and the nerve is exposed until its entry into the trapezius. The contents of the posterior triangle cranial to the nerve are dissected until the posterior border of the sternomastoid. The muscle is now cut at its most cranial attachment. This manoeuvre brings the posterior belly of digastric muscle into view and the accessory nerve, the internal jugular vein, the hypoglossal and the vagus nerves and the internal and external carotid arteries can be identified in that order from behind forwards. The accessory nerve lies posterior to the vein in 80% of cases, anterior to the vein in 10% and medial to it in the rest. The nerve is followed through the muscle which is split. It is important to follow the lateral part of the nerve as this is the main continuation into the posterior triangle. The medial branches of the sternomastoid and the cervical component of the nerve from the cervical plexus are severed. The internal jugular vein is ligated just under the digastric and cut.

It is argued that ligation of the vein caudally prevents dissemination of cancer cells into systemic circulation. This has never been documented. Besides, there are other channels of spread available for the tumour cells. Ligation of the vein cranially obliterates the most important venous flow and the vein does not

swell up as it does when first ligated caudally, thus making dissection easier. In about 5% of cases the internal jugular vein may be duplicated in its most cranial portion. Both veins are then ligated. The part of the posterior triangle caudal to the accessory nerve is then dissected and the specimen brought from behind forwards. The sternomastoid is severed from its clavicular attachment and the internal jugular vein is ligated caudally. The rest of the steps in the dissection are the same as in a classical neck dissection. In an irradiated neck and/or when the internal jugular vein is preserved, modified McFee's incision is preferred. This protects the vein and primary wound healing is assured. Whenever feasible it is a good policy to perform an en bloc dissection along with the primary tumour. However, this may not always be possible. In a comparative study of en bloc dissections as against discontinuous dissections Leemans et al found a higher (11% vs 19%) incidence of recurrence in the neck in discontinuous dissections for the same tumours. The 5 year survival in discontinuous dissections was 17% poorer than in the continuous or en bloc group (80% vs 63%) (Leemans et al, 1991).

FUNCTIONAL NECK DISSECTION

Bocca coined the term functional neck dissection to describe a technique whereby all the lymph nodes and the areolar tissue and fat contained within the layers of the prevertebral fascia and the investing layer of the deep cervical fascia are removed with preservation of the X, XI, XII cranial nerves and the internal jugular vein as well as the sternomastoid muscle. In addition the omohyoid and digastric muscles, the common facial vein, the submandibular salivary gland as well as the cervical plexus are preserved. Bocca compared the results of NO and N+ necks in 1200 functional neck dissections carried out on 843 patients in a 18 year period between 1961 and 1979. It is significant to note that the recurrence rate in 672 'NO' necks was 2.38% as compared to a recurrence rate of 30.4% in 171 with N1 or N2 necks operated over the same period of time (Bocca et al, 1984).

SELECTIVE NECK DISSECTIONS

These are actually partial dissections or dissection of nodes at maximum risk in relation to a particular site of primary tumour. The various types of selective dissections, the levels or localisation of lymph nodes cleared and the site of primary tumour for which they are indicated is shown in the following table.

Type of selective dissection	Level or groups of nodes cleared	Structures preserved	Site of location of primary tumour
Supraomohyoid	I to III	SAN, IJV, SGM	Oral cavity (lower lip-ant., floor of mouth)
Lateral	II to IV	SAN, IJV, SCM	Larynx, pharynx
Antero-lateral	I to IV	SN, IJV, SCM	Oral cavity
Anterior compartment	II to IV + para and pre tracheal nodes	SAN, IJV, SCM	Thyroid
Postero lateral	II to V + Radical-postauricular and superficial occipital nodes	None	Malignant melanoma and other malignancies of the scalp

Types of modified radical neck dissections:

Type I	SAN
Type II	SAN and IJV
Type III	SAN, IJV and SCM

The type of posterolateral dissection is dependent upon the size and virulence of the primary tumour. In all subglottic tumours a paratracheal dissection is carried out as well. There are no comparative studies between selective and modified radical neck dissections. The supraomohyoid dissection is one of the most frequently used procedures.

Until controlled comparative studies are carried out, it is safe to assume that functional, supraomohyoid and probably lateral neck dissections for N1 and N2 necks carry

approximately 30% risk of recurrence. The value of selective dissections lies in their functioning as staging procedures. The whole specimen of selective dissection can be sent for frozen section and the dissection converted to modified radical in case positive nodes are found. Obviously this means additional operating time. Some clinicians like to include level IV along with I to III. These procedures are called anterolateral dissections.

In laryngeal carcinoma levels II, III and IV are dissected. A modified Gluc Sorenson incision beginning on the mastoid process on the side of the intended neck dissection, over the sternomastoid and the suprasternal notch to the level of the hyoid on the opposite side is taken.

There is no place for a suprahyoid dissection in the treatment of cervical lymph node metastases.

Posterolateral dissection of the neck was first described by Rochlin and has since been reported by Geopfert and others (Rochlin, 1962; Geopfert, 1980).

A posterolateral dissection is indicated for cancer of the skin and melanomas in the occipital of retroauricular areas. Contents of the posterior triangle along with the retroauricular and suboccipital nodes are cleared up to the accessory nerve in the posterior triangle. The sternomastoid muscle is retracted anteriorly and the subdigastic and midjugular (levels II and III) nodes are include. The trapezius muscle is separated from the nuchal line and resected down to C3 or C4. The occipital artery is identified and removed along with the suboccipital nodes. In case the nodes along the course of the accessory nerve are suspicious, a frozen section is carried out. In the event of a positive node being presented, the nerve is sacrificed.

NECK DISSECTION IN SALIVARY GLAND CARCINOMA

There are three determining factors which influence the decision to perform a neck dissection in patients with carcinoma of the salivary glands. It has already been mentioned that a neck dissection should be a part of treatment whenever a sublingual, submandibular

or the deep lobe of the parotid gland is the seat of malignancy. Incidence of lymph node metastases from submandibular gland is higher than the rest. However the majority of tumours affect the superficial lobe of the parotid gland. In a N+ neck the decision is simple and the parotidectomy incision is extended to the suprahyoid and submental area. In a 'NO' neck a neck dissection is advisable in a tumour stage T2b or higher (according to WHO staging 1989), as the likelihood of lymph node metastases is around 25%.

Although the current WHO classification describes 17 different types of salivary gland carcinomas, there are six varieties which are most likely to metastasise to cervical lymph nodes. There are high grade mucoepidermoid carcinoma, adenocarcinoma, adenocystic carcinoma, undifferentiated carcinoma, squamous cell carcinoma and carcinoma arising in a pleomorphic adenoma.

Since a parotidectomy is not always a microscopic radical procedure especially in a stage T2b or higher stages of tumour, adjuvant postoperative radiotherapy is necessary. In such cases the neck is included in the field of radiation and an elective neck dissection is not called for in 'NO' neck.

The subdigastic area is always exposed in all cases of salivary gland carcinoma and it is authors practice to perform a frozen section of the subdigastic node (level II) in all doubtful cases to determine whether to proceed with a neck dissection.

NODAL METASTASIS FROM THYROID CARCINOMA

The risk factors in thyroid carcinoma are age and tumour grade. High grade tumours and age below 20 or above 70 are considered unfavourable. In well differentiated carcinoma of the thyroid gland a thorough clearance of the prelaryngeal, pretracheal, paratracheal, paraoesophageal and superior mediastinal nodes is indicated. These

are collectively referred to as the central compartment nodes. An elective neck dissection is not indicated as it does not alter the outcome, but in the presence of positive nodes along the internal jugular vein a modified radical neck dissection is indicated (Shah et al, 1993). Some surgeons prefer to preserve even the vein and the sternomastoid muscle in addition to the accessory nerve.

“Node picking” is to be avoided if local recurrences are to be prevented.

BILATERAL NECK DISSECTIONS

In patients with bilateral suspicious nodes (N+) and in those with large (T3, T4) lesions of oral cavity, oropharynx and hypopharynx extending across the midline, bilateral nodal clearance is indicated. The question to be answered in case of a bilateral N+ neck are : Should both necks be operated simultaneously or can they be staged? In the presence of bilateral suspicious nodes, it is authors policy to operate simultaneously, but preserve the internal jugular vein at least on one side i.e. the least involved side. If possible the accessory nerve is preserved on both sides. It is advisable to begin on the side where a vein sparing procedure is contemplated and a modified McFee incision is preferred. If the condition of the patient is too poor to stand a bilateral simultaneous dissection, the procedure may be staged and the second neck dissection performed two to four weeks later. Even staged bilateral neck dissections carry increased risk of complications. Long term survival of patients with bilateral positive neck nodes (N2c) is also poorer (Baffi et al, 1980). There is risk of raised intracranial pressure and blindness if bilateral ligation of internal jugular veins is carried out at the same sitting (De Vries et al, 1986). Increased intracranial pressure as a complication following unilateral neck dissection in a patient with congenital absence of transverse sinus has been reported (Lydiatt et al, 1991). Incisions should be carefully planned and flaps raised with due care if problems with wound healing is to be avoided. Whenever bilateral neck dissections are

carried out it is always safe to perform a temporary tracheotomy. Oedema of the larynx can develop sometimes rapidly in these cases and may compromise the airway. One of the mistakes frequently committed is to perform a tracheotomy after bilateral neck dissections with the skin flaps raised. Once the flaps have been raised, the skin retracts sometimes considerably. A tracheotomy fixes the flap in this position and it cannot be brought back to its intended position without traction, thereby increasing the risk of necrosis of the tip. This is a common cause of non union at the three point junction in such cases. When the primary tumour extends beyond the median line, but the contralateral nodes are clinically negative in the oral cavity and oropharynx it is authors preference to perform a comprehensive dissection on both sides with preservation of at least one internal jugular vein and if possible both accessories nerves.

In large metastatic nodes often the subject of discussion is whether the mass is operable. Not uncommonly the overlying skin may be fixed and the mass may even have been biopsied for diagnosis, making matters still worse. Clinically if the mass is mobile both in the transverse as well as the vertical axis, it is in all probabilities operable i.e. dissectable free from the carotid vessels. A CT-scan should be looked carefully for a thin hairline space between the neck mass and the arterial wall. When present, this denotes a plane of cleavage which the operator could exploit to dissect the mass free. These masses may be fixed to the adventitia of the arterial wall, but the muscular wall of the artery is free. It is best to open the adventitia at a distance from the tumour and dissect between it and the media. It is useful to leave a clip or two to exactly mark the area of arterial wall involvement for future orientation by the radiotherapist or if intraoperative radiotherapy is planned. Infiltration of the media or muscle layer of the carotid artery is a bad sign and such vessels are prone to rupture. Stell reported a 5-year survival of 15% in N3 necks (Stell et al, 1984).

Salvage surgery for recurrence after neck dissection has dismal prognosis. Urken et al reported salvage procedures on 10 patients with 3 survivals for 12 months and one for 42 months (Urken et al, 1986).

COMPLICATIONS

Some of the complications of neck dissection have been referred to during the course of above discussion. Most complications can be avoided by proper planning and execution of incisions, raising of flaps, placing and timing of removal of drains and proper wound closure. Patients who have been radiated and those where muscle or myocutaneous flap has been raised continue to produce serous exudate for periods varying from three to five weeks. Early removal of drain often leads to seroma formation and delayed wound breakdown. Should a seroma be discovered after the drains have been removed, this can be aspirated daily until no further fluid can be aspirated. Necrosis at the three point junction is avoided by proper placement of the vertical limb of the incision at right angles to the suprahyoid limb and whenever possible keeping the platysma in the flaps. This junction should not be placed over the carotid vessels. Should necrosis occur, then it should be removed and the vessels protected by a muscle or myocutaneous pedicled graft usually from the ipsilateral pectoralis major. One of the serious, but not uncommon complications of neck dissection is chylous leak. The thoracic duct emerges into the neck on the left side close to the oesophagus and runs vertically for about 3 cm. It then turns laterally in a gentle curve behind the common carotid artery and the internal jugular vein to appear posterolateral to the vein and enter the subclavian vein near its junction with the internal jugular vein. To avoid injury

to the thoracic duct, it is important to be aware of its presence, since it is not always visible during the procedure and to avoid brisk dissection in the supraclavicular area. When large nodal metastases at this level are present especially if the nodes are fixed to the vein the duct may be damaged during the dissection. The flow of colourless fluid in the area which reappears each time it has been mopped should make one aware of the damage. It is better to look for it straight away and ligate it. At the end of the procedure all neck wounds are irrigated thoroughly and it is then again advisable to check that there is no leakage. Drains should not be placed in its vicinity. In case the leak is not controlled, the scalenus anterior or scalenus medius can be or transposed and the leak sealed with it.

Should the leak be discovered postoperatively the continuous vacuum drain is kept in place to allow the skin flaps to fall back on the prevertebral muscles and the amount of chyle measured accurately every day. All intraoral or intragastric feeds are stopped and parenteral feeds are resumed. Usually the amount of production of chyle will diminish steadily and stop in three to five weeks if not earlier. Local injection of tetracycline has been reported. Experience is that it is not reliable and produces intense pain. Not only does this complication disturb the nutritional and crystalloid equilibrium, but it delays recovery so that postoperative radiotherapy is often delayed. It is then better to reexplore the wound, find the leakage and ligate and if necessary transpose a muscle flap. Pectoralis major muscle flaps have often been used.

Injury to brachial plexus is a serious and fortunately uncommon complication. Careful technique and avoidance of the use of diathermy in the vicinity of nerves is advisable.

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