ORIGINAL ARTICLE

Incidence and Clinical Analysis of Complications of Neck Dissection

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Abstract The aim of the study was to assess and evaluate the incidence of complications related to type of neck dissection to different variables. Retrospective study was conducted on patients who reported to our craniofacial centre between 2010 and 2019 and underwent neck dissection for evaluation of complications related to it. Records of all patients were analysed for complications which were alienated into intra-operative, immediate post-operative (within 10 days) and post-operative complications. 256 patients, 141 male and 115 female aged between 25 and 70 years operated for squamous cell carcinoma were included. The overall incidence of complications was 32.8%. Intra-operative complications were haemorrhage 14%, nerve injury 5.4%, inadvertent internal jugular vein ligation 0.3%, chyle leak 0.3%. No incidence of carotid blow out. Immediate post-operative complications were hematoma formation 7%, salivary fistula in 2.3% and re-exploration was done in 1.5% cases. Post-operative complications noted were wound dehiscence in 22.6%, infection in 20.7%, hematoma in 2.7%, salivary fistula in 11.7% and nerve injury in 0.3% cases. Neck dissection is a

challenging and therapeutic procedure. Prevention of major complications like carotid blow-out, injury to brachial plexus, vagus nerve or hypoglossal nerve requires thorough knowledge of neck anatomy.

Introduction

Neck dissection is a surgical technique for removal of fibro-fatty tissue along with lymph nodes and non-lymphatic structure for regional control of spread oral squamous cell carcinoma. This can be done for clinically and / or radiologically apparent lymph nodes or as share of curative surgery where menace of occult nodal metastasis is reckoned satisfactorily high. In the management of head and neck cancer the utmost imperative prognostic aspect remains the manifestation of cervical lymph node metastasis. The existence of metastatic lymph nodes downcast the disease-free survival by 50% [1].

Neck dissection has been a well-known surgical procedure for diagnosing (staging) and handling head and neck cancer for nearly an era. The basis of treating oral squamous cell carcinoma which metastasizes to regional lymph nodes is based on the circumstance that spread by tumour emboli is the norm and it results in metastasizes.

The goal in the management of malignancy is tumour ablation by means of preservation of all vital and uninvolved structures. Reliant on the site and extent of the tumour, the sort of neck dissection executed may be radical, modified, selective or extended and it may be either unilateral or bilateral. Neck dissection like any other surgery may give rise to complications during or after surgery.

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The overall incidence of complications of neck dissection in literature ranges from 19.51% [2] to 39.4% [3]. In some cases loss of function and cosmetic compromise is foreseeable, even with a ''conservative'' approach to ablative surgery because of the highly specialized tissues involved. Postoperative complications after neck dissection has a noteworthy impact on morbidity and health care cost, leading to extended hospital stay, adjunctive measures, long-lasting sequelae, and at times a lethal outcome. Even though this has been verified to be of survival benefit, in sites such as tongue, the rate of occult cervical disease is 50%. Despite of which majority of patients undergoing an elective, staging neck dissection will ultimately be disease-free [4, 5].

Morbidity is eminently curtailed by a scrupulous approach which begins in the out-patient location. Hence approach to the care of patients undergoing neck dissection instigates with pre-operative assessment and peri-operative care preceding to contemplation of surgical technique itself.

A systematic review of complication chart of 256 patients who underwent neck dissections was done. Complications of neck dissection are alienated into three foremost sets: intra-operative complications, immediate postoperative complications and postoperative complications. The objective of the study was to analyse the incidence of complications in patients undergoing neck dissection with oral squamous cell carcinoma in relation to age group, etiological factors, co-morbidities, histopathology reports, TNM staging and type of neck dissection, and to seek improved patient care and outcome.

Materials and Methods

Retrospective study was conducted on patients reporting to our craniofacial centre between 2010 and 2019 who had surgical management of squamous cell carcinoma using MRND, SOHND or RND and reconstruction with loco-regional flaps such as Temporalis muscle flap or PMMC and free vascularised flaps such as free fibula, radial forearm free flap, anterolateral thigh flap. The data was collected from medical records of the patients which had a standardised demographic, pre, intra and post-operative follow up details.

280 patients were operated out of which 256 patients who fulfilled the inclusion criteria such as who were in age groups from 20–70 years, medically fit with or without co-morbidity, biopsy proven cases of squamous cell carcinoma with lymph node metastasis and no evidence of distant metastasis were included in study. Patients who had undergone preoperative radiotherapy, new adjunctive chemotherapy, advanced disease with neck nodes involving the Internal jugular vein and carotid and 24 patients whose medical or follow up records were not available were excluded. Out of 256 patients, 84 patients with complications were involved in the study. Patients were divided into three groups:

GROUP I: Intra-operative complication.
GROUP II: Immediate post-operative complication (within 10 days).
GROUP III: Late post operative complication.

The patients records were evaluated for investigations such as physical examination, chest radiographs, haematology and biochemistry tests, electrocardiograms, biopsy of the primary tumour, TNM staging, USG and clinical evaluation of neck, Computed tomography scans/ MRI scans to for planning the extension of the resection of primary tumours and type of incision- Schobinger incision / Mac fee incision.

Complications exemplified were wound dehiscence, hematoma formation, salivary fistula, re-exploration, carotid blow-out/major vessel rupture such as Internal Jugular Vein, shoulder morbidity, chyle leak, nerve injury, infection and were compiled for all the above mentioned variables. Data was statistically analysed by chi-square test. Clearance from Institutional Review Board obtained.

Results

The incidence of complications was noticed in 84 patients (32.8%). The complications were minimal in the age group of 21–30 years (19%) and maximal in the age group of 61–70 years (85.7%). Overall complication gender wise was 51.7% in males and 9.5% in female. The most common etiological factor associated with complications was smokeless tobacco (22.6%) followed by alcohol consumption (19%) and tobacco smoking (17.9%) and least was seen in trauma patients (1.5%). Complications were also noticed in patients with no relevant history (3.9%). Co-morbidities such as diabetes mellitus (22.6%) and hypertension (18.3%) was associated with maximum complications. 23 cases (8.9%) who had complications, no systemic illness was found in them. These co-morbidities were optimized before the patients were posted for surgery. Site predilection was seen in cases involving lateral border of tongue (37.5%) followed by gingiva-buccal sulcus (34.8%) and mandibular alveolar ridge (34.7%). Minimum complications were noticed in buccal mucosa (18.5%) cases. Histopathological well differentiated 45 cases (39%) had maximum complications. Minimum complications were seen in supra-omohyoid neck dissection (25.7%) and maximum were in modified radical neck dissection (35.4%). Maximum complications were seen in marginal

mandibulectomy (42%) and least in combined hemi maxillectomy with hemi mandibulectomy (13%).

Intra-operative complications were haemorrhage 36 (14.06%), nerve injury 14 (5.47%), inadvertent internal jugular vein ligation 1 (0.39%) (Fig. 1), chyle leak 1 (0.39%). No incidence of carotid blow out noted.

Most common immediate post-operative complications was hematoma formation 18 (7.03%) followed by wound dehiscence 12 (4.69%) and infection 8 (3.13%). Re-exploration was done in 4 cases (1.56%)(Fig. 2). Salivary fistula formation was seen in 6 cases (2.34%) and chyle leak in 1 case (0.39%). No major vessel rupture, shoulder morbidity or nerve injury was noted.

Late post-operative complications noted was wound dehiscence accounting for maximum 58 (22.66%) (Fig. 3) and infection 53 (20.70%), hematoma formation in 7 cases (2.73%), Salivary pooling was seen in 30 cases (11.72%) (Fig. 4) and nerve injury in 5 cases (0.39%) (Fig. 5). NO major vessel rupture or chyle leak was noted.

Discussion

In neck dissection, presence or absence of neck nodes is one of the imperative prognostic factors. Evidence of positive metastatic lymph nodes brings down survival rate by 50%. The extent of removal is determined by various factors like primary site, type, histodifferentiation, size, nodal metastasis, depth and extracapsular spread. The lymph node clearance along with removal of the spinal accessory nerve,internal jugular vein and sternocleido-mastoid muscle as share of the surgical treatment of head and neck cancer was commenced by George Washington Crile of the Cleveland Clinic in 1906. It was consolidated in a definite manner by Hayes Martin. In the 1967, Oscar
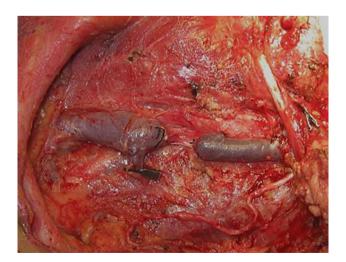

Fig. 1 Inadvertent internal jugular vein ligation

Fig. 2 Re-exploration

Fig. 3 Wound dehiscence

Fig. 4 Salivary pooling

Fig. 5 Facial nerve palsy

Suarez and E. Bocca self-reliantly pronounced a supplementary conservative technique that involved elimination of all the lymph nodes and sparing of the spinal accessory nerve, sternocleidomastoid muscle and internal jugular vein. These modified versions of radical neck dissection have been collectively referred to as 'functional' or 'modified' neck dissection.

The incidence of complication was 32.8% in our study as compared to reported in literature 39.4% [2]. Cumulative analysis of complications of the neck dissection has not been highlighted in literature. The complications were minimal in the age group of 21-30 years (19%) and maximal in the age group of 61–70 years (85.7%) this is due to comorbidities seen in that age group. Overall complication gender wise was 51.7% in males and 9.5% in females.

The co-morbidities such as diabetes mellitus (22.6%) and hypertension (18.3%) were associated with maximum complications, which were mainly infection, wound dehiscence, and haemorrhage are attributed compromised defence host and it was noted hypertensive patients had episodes of haemorrhage due to variation in the parameter. Site predilection was seen in cases involving lateral border of tongue (37.5%) followed by gingivo-buccal sulcus (34.8%) and mandibular alveolar alveolar ridge (34.7%). In any oral cavity resection the primary objective is to reconstruct the site and reproduce a good oral cavity seal to prevent communication with the neck. Any deviation in this will exhibit complications related more to these primary sites. Minimum complications were noticed in buccal mucosa (18.5%) cases. Minimum complications were seen in supra-omohyoid neck dissection (25.7%) and maximum were in modified radical neck dissection (35.4%), this is due to difference in the surgical technique, MRND needs careful dissection around the IJV and spinal accessory nerve to the preserve the structures. Higher incidence of complications were seen in marginal mandibulectomy (42%) and least in combined hemimaxillectomy with hemimandibulectomy (13%).

When compared with the type of incision for neck wound dehiscence was prevalent in Schobinger incision n = 47 (38.8%) contemplated to Macfee incision n = 37 (27.4%) due to reduced vascularization at the periphery of the skin followed by ischemia. In order to maximize the blood supply to skin flaps it should be elevated in the sub-platysmal plane lest local disease dictates otherwise [6].

Intra-operatively minor haemorrhage was seen in 36 (14%) cases inspite of infiltration with vasoconstrictor agent, direct cauterization, ligation. Hematoma formation was distinguished as fast filling drain, distinct swelling or ballooning of the skin, external bleeding through the incision in 18 cases (7%) in immediate post-operative period out of which 4 cases (1.5%) underwent re-exploration. In post-operative period hematoma formation was seen in 7 (2.7%) cases which was managed conservatively by pressure dressing and continuous suction drainage for evacuation of the accumulated blood. Intraoperative hemorrhage can be achieved by avoiding pre-operative use of anticoagulants and antiplatelet agents. To preclude hematoma formation meticulous hemostasis was attained and prior to closure at least two medium sized surgical drains was placed in the submandibular triangle and posterior triangle. Intraoperatively venous bleeding is expected from EJV, IJV, common facial vein, vena commitans. Arterial bleeding may be from transverse cervical artery, superior thyroid artery, facial artery, occipital artery. It is prudent to ligate all the arteries and veins especially at lower end and upper end of the neck and whenever in doubt, better to transfix the artery or use of continuous sew sutures to prevent intra-operative and post-operative hemorrhage.

Inadvertent ligation of internal jugular vein was seen in 1(0.3%) case due to anatomic variation, post-operatively there was no increase in intracranial pressure which regularly occurs when the internal jugular vein is ligated. When one internal jugular vein is ligated the pressure escalates by threefold and when both are ligated it intensifies by fivefold. This often is momentary and will stabilize in 24 h. In our series none of the patients had any major complication except the postoperative swelling which was more.

No carotid blow out was noted. Postoperative carotid artery rupture, or "blow out" incidence in literature is 3% to 4% of radical neck dissection and it is associated with

50% of mortality rate. Measures taken to prevent were intraoperative careful dissection, avoiding the trifurcation point of neck incision coming over the carotid, good vascular cover like use of PMMC flap, good neck closure, aggressively treating the neck infection with culture and appropriate systemic antibiotics, regular dressings and nutritional support.

Chyle leak was seen in 1 patient (0.3%) as equated to study conducted by Smoke A [7], in which 2 patients developed chyle leak. The leak was small that is < 400 ml/day, which was managed conservatively with head up position, pressure pack, low fat diet and parenteral fluid replacement.

Cutaneous nerve injury was seen in all cases who underwent neck dissection. Sensory branches of the cervical roots C2, C3 and great auricular nerves provide sensation to skin of the neck and shoulder. Sacrifice of these branches results in a sensory deficit, that encompasses from pinna to the chest wall below the clavicle. Most of these sensory deficit does not cause major morbidity for the patients.

In our study marginal mandibular nerve dysfunction was seen in 14 cases (5.4%) as compared to 40% [8] and 58% [9], permanent dysfunction was noted only in (1%–3%) few cases. It is imperative to preserve marginal mandibular branch of facial nerve when raising the subplatysmal flap, but the scenario in which marginal mandibular nerve causes difficulty in resecting level IB or level IIA nodes, nerve is sacrificed for oncologic reasons.

Hypoglossal nerve is vulnerable to injury during dissection of level III, as it crosses above the carotid bifurcation near the greater cornua of hyoid bone. There were no incidence of this nerve injury which is one of the dreaded and fatal complication if injured in bilateral neck dissection.

None of the patient had vagus nerve and phrenic nerve injury the importance which is well established in the literature [10]. It is imperative to have sound knowledge of neck anatomy and these important structures are well protected unless gross deviation of plane is carried out.

Injury to brachial plexus is uncommon and is avoided by undermining the posterior triangle of the neck and visualizing the entire brachial plexus prior to transection or to clamping of the posterior triangle fat. It is prudent to avoid the electrocautery and to use scalpel for suprafascial dissection. Injury to this can lead to sensory and motor deficit to forearm. In our study there was no incidence of this complication.

Spinal accessory nerve injury was associated with shoulder morbidity in 18 patient (7%). The utmost prevalent postoperative complications of neck dissection include pain and weakness of the shoulder [10]. In our study shoulder dysfunction was seen in 58% of cases. Leipzig et al. [11] found that 25% of patients who underwent nerve-sparing neck dissections settled a permanent shoulder droop. These outcomes may be initiated by traction injury, devascularization, or inadvertent transection of the nerve [12, 13] in our series 48% of patients showed good resolution of shoulder morbidity with institutional and home remedy physiotherapy regimen.

Salivary pooling or fistula formation was seen in 6 cases (2.3%) in immediate post-operative period. It was managed by regular tapping, culture and sensitivity testing to rule out infection, subjecting patients to radiotherapy immediately after the healing. Intra-operatively water tight layered closure of parotid tail is recommended [14].

Wound dehiscence was more common in post-operative period n = 58(22.6%) as compared to immediate postoperative n = 12(4.6%) in contrast to study conducted where 12% wound infection and 5% flap necrosis was noted [15]. Wound dehiscence was managed by debridement, resuturing, VAC dressing. The criterion used to differentiate between extended or regular wound dehiscence was the presence of a "dehiscent area" ≥ 2 cm [16]. Wound infection may be apparent as a cellulitis with erythema, warmth, or induration of the cervical skin flaps, abscess formation from an infected seroma or hematoma, or fistula. It may result in unanticipated scarring, flattened appearance and pain. The role of radiotherapy did not show any significant changes in the neck healing. In 4 patients (3.3%), there was evidence of mild skin margin wound dehiscence at trifurcation area which was managed with regular dressing.

Infection was seen in 8 (3%) cases in immediate post-operative period and in 53(20.7%) cases in post-operative period, it was managed by antibiotics based on culture and sensitivity. Pre-operatively 3 doses of azithromycin 500 mg is given as prophylactic means. If concomitant en-bloc resection of a primary oral or oropharyngeal lesion is planned, the ensuing through and- through defect escalates the degree of wound infection in the neck. Topical treatments with either antiseptics or antibiotics have been verified to be beneficial [17]. Prophylactic antibiotics should be continued for 24 to 72 h postoperatively. Meticulous suturing of the resultant defect minimized the degree of infection in the neck. The oral mucosa was sutured in two layers which added to its strength. It is important to provide a good oral seal especially when the reconstruction flap is placed to prevent communication between the oral cavity and the neck. In all our cases we have used vertical mattress suturing for insetting of the flap, thus providing water tight closure. Decreasing the time-frame of peri-operative management with intra-venous antibiotics confines the progress of drug-resistant bacterial infection, e.g.,Methicillin-Resistant Staphalococcus Aureus [18].

To conclude neck dissection is a paramount procedure in management of oral squamous cell carcinoma. The minor complications are part of any other surgical procedure. But prevention of major complications like carotid blow-out, other major vessel bleeding, injury to brachial plexus, vagus nerve or hypoglossal nerve injury requires expertise and thorough knowledge of neck anatomy. Though it is a retrospective study with good material, there was no incidence of mortality either intraoperative and postoperative phase, and it sends out a message that neck dissection is a challenging and therapeutic procedure with minimal morbidity.

Declarations

Conflict of Interest The author declare that they have no conflict of interest.

Ethical Approval The manuscript was cleared by Institutional Review Board for publication.

Patient Consent Consent has been taken by the patient.

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