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# An observational prospective study to evaluate outcomes in free flap surgery after the application of enhanced recovery after surgery (ERAS) protocol

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**Abstract**

The study evaluated the overall length of stay, ICU stay duration, and opioid use in ERAS versus non-ERAS groups and assessed ERAS pathways' impact on flap-related complications. Sixty-four patients (32 in each group) were enrolled. Patients were informed about ERAS guidelines during OPD visits and admitted a day before surgery. Written consent was obtained, and preoperative instructions were followed. Expert anesthesiologists intubated patients, and Flotrac monitors were used. Patients underwent oral composite resection and free tissue transfer (ALT free flap, vascularized fibula flap, or radial forearm free flap). Post-surgery, patients were shifted to the ICU, and postoperative protocols were followed. The study compared historical non-ERAS cases with ERAS protocols.

Observations:

**Non-ERAS Group:** 44% under 60 years, 56% over 60 years; ERAS group: 69% under 60 years, 31% over 60 years.

**Male Predominance:** Non-ERAS (78%), ERAS (94%).

Lesions involved buccal mucosa (62.5%) and mandible (71%-75%) in both groups.

63% of patients had no comorbid conditions.

Patients underwent OCR followed by free flap coverage.

Postoperative care included hourly flap monitoring, extubation the next morning, IV fluids tapered, and patients were shifted to the ward.

Patients were mobilized on postoperative day (POD) 2, and flap monitoring continued every 2 hours for 24 hours.

**POD 3:** Full nutrition via NGT, speech, and language assessment, check for flap complications.

**POD 4:** Sips of water, then free fluids if safe; neck drain removal if output <30 ml/24 hours.

**POD 5:** Liquid diet if swallowing well.

**POD 6/7:** Continued liquid diet; neck drain removal if output <20-30 ml/24 hours.

**POD 8/9:** Patients resumed normal activities and were discharged.

Follow-ups occurred at 1 week, 2 weeks, and 1 month post-discharge. The ERAS group had a shorter overall length of stay ($p<0.001$). Patients under and over 60 years had shorter stays in the ERAS group ($p=0.009/0.002$). Bony resection patients in the ERAS group had shorter stays ($p<0.001$), though the difference was not significant for soft tissue resection ($p=0.501$). ERAS patients who underwent segmental mandibulectomy, marginal mandibulectomy, maxillectomy, and buccal mucosa resection had shorter stays ($p<0.001$). ICU stay and opioid use duration were shorter in the ERAS group ($p=0.003/0.005$). Thus, the ERAS program is safe, effective, and reduces hospital stay and resource utilization.

**Keywords**: Free flap surgery, enhanced recovery after surgery, ERAS protocol

## 1. Introduction

The concept of traditional care with recovery is based on the fact that surgical aggression routinely causes metabolic, hormonal and physiologic modifications that retard convalescence, and hence, interfere with the time of the patient to return home. The effects of this aggression can be amplified by extrinsic factors such as peri-operative nil by mouth or the onset of medical or surgical complications. Intrinsic factors (active smoking/consumption of tobacco in any form, metabolic or cardiovascular disease, etc.) can also negatively influence the postoperative hospital stay and retard convalescence.

The basic goal of enhanced recovery is to allow the patients to recover his/her physical and psychological capacities as quickly as possible. Enhanced recovery protocols are multidisciplinary procedures that involve more than one departments like head and neck oncosurgeons, plastic and reconstructive surgeons, anesthesiologists, and all of the healthcare team such as nutritionists or physiotherapists.

Enhanced recovery programs start pre-operatively, when the head and neck oncosurgeon, plastic surgeon and the anaesthesiologist first sees the patient and do not finish until the patient returns home. To evaluate the pertinence of these programs, the indicators usually taken into consideration during regular audits include hospital stay, readmission rate during the first postoperative month and postoperative complication rate [2].

In the current health care practice globally, tertiary care centres must achieve a delicate balance between limiting expenses, proper utilization of resources and delivering high-quality care for any number of patients. Multimodal peri-operative care protocols, also known as enhanced recovery or fast-track surgery protocols, have been introduced recently to achieve early and enhanced recovery for patients undergoing major surgery, thus allowing for a decrease in total hospital length of stay (LOS) [3].

According to the ERAS Society, the core elements of ERAS pathways address the key factors that keep patients hospitalized after surgery such as need for extra hydration, keeping patient warm, need for parenteral analgesia, and early mobility. ERAS pathways have successfully decreased hospital LOS, decreased duration of postoperative recovery, and hence possibly decreased surgical morbidity by reducing the physiologic trauma caused by the surgical procedure and postoperative care. In the current scenario, ERAS pathways may also provide the additional benefit of decreasing health care expenditures by better resource utilization while improving quality of care and patient satisfaction [3].

The implementation of ERAS protocols helps in a significantly minimizing hospital LOS and potentially decreases the use of resources as compared to traditional protocols. The implementation of an ERAS programme and costs involved in setting up and maintaining such an ERAS programme was much less compared to costs saved in reduced postoperative resource utilization like significant reduction in total hospital stay, intravenous fluid use, complications and duration of epidural use in the ERAS group. There are no adverse effects of this study as it is an observational study and follow up assessment is a part of routine care.

These benefits of ERAS protocols have been published, predominantly in gastrointestinal surgery, but also in vascular, hepato pancreaticobiliary, bariatric, esophageal, orthopaedic and gynecologic surgery. To our knowledge, outcomes of implementing ERAS pathways in patients undergoing plastic and reconstructive surgery have not been evaluated. The purpose of this study is to investigate the feasibility and safety of a procedures specific ERAS pathway uniquely designed for patients undergoing microsurgical free flap reconstruction following resection of oral malignancy [3].

The ERAS Protocol is the evidence-based care protocol developed by the ERAS Society. The ERAS protocol describes the perioperative care pathway with recommendations for patient care at various steps in the pre/intra/post-operative process. There are around 20 care elements that have been shown to influence peri-operative care duration and postoperative complications. The following list illustrates the key components of the ERAS multimodal management pathway [4].

**Pre-Operative**

- Oral and written information of patient and relatives about all aspects of perioperative care.
- Pharmacological prophylaxis of postoperative nausea or vomiting.
- Antibiotic prophylaxis and thromboprophylaxis.
- Pre-emptive analgesia initiated before surgery.

**Intra-Operative**

- Opioid-sparing anesthesia and analgesia, including a thoracic epidural with local anesthetic or intravenous patient-controlled analgesia.
- Infiltration of all incisions with local anesthetic.
- Goal-directed fluid therapy; minimizing fluid overload.
- Avoidance of drains and nasogastric tube.
- Maintainence of Normothermia.

**Post-Operative**

- Enforced early enteral feeding.
- Liberal use of chewing gum and laxatives.
- Preservation of sleep pattern by liberal use of night-time sedative.
- Enforced early ambulation.
- Breathing exercises.
- Avoidance or early removal of urinary catheter.
- Early withdrawal of intravenous fluid therapy.

Initiated by Professor Henrik Kehlet in the 1990s, ERAS, enhanced recovery programs (ERPs) or "fast-track" programs have become an important focus of perioperative management [5, 6]. These protocols attempt to modify the physiological and psychological responses to major surgery, and have been shown to reduce complications and length of hospital stay, improvements in cardiopulmonary function, earlier return of bowel function and earlier resumption of normal activities.

The key principles of the ERAS protocol include preoperative counselling of patient and attendee, Prophylaxis of postoperative nausea or vomiting, preoperative nutrition, avoidance of pre or postoperative fasting and carbohydrate loading up to 2 hours preoperatively, Enforced early oral/enteral feeding post operatively, liberal use of chewing gum and laxatives, standardized anesthetic and analgesic regimens (epidural and non-opiod analgesia) and early mobilization [7].

Enhanced recovery after surgery (ERAS) protocols represent a multimodal approach to improve the patient's quality of postoperative care by diminishing the stress response to the trauma of an surgery, thereby decreasing hospital length of stay, reduce patient morbidity and associated potential complications. The success of ERAS fast-track surgery pathways-thoroughly studied in the colorectal literature-has led to their application in other fields[1].

Oral cancer is one of the major threats to public health; with increasing incidence in most countries [8]. As per the reports submitted by GLOBOCAN 2012 [9] (International Agency on Cancer), section of cancer surveillance, the incidence of cancer of lip/oral cavity is 4 per 100000 population (5.5 in men and 2.5 in women). The Oral Cancer Foundation states that highest rates of oral cancer are reported in South Asian countries such as India and Sri Lanka. In India, the age standardized incidence of oral cancer is 12.6 per 100000 population as per the National Cancer Registry. The cancer epidemic is increasing in developing countries due to combined effect of ageing population and high prevalence of cancer risk factors such as tobacco consumption in the form of gutka, quid, snuff or MISRI and alcohol consumption, unhealthy diet and infections [10].

Surgical excision of the primary lesion and the cervical lymph nodes forms the mainstay of treatment in most instances with addition of radiation or chemotherapy as an adjuvant depending on the stage of the disease at presentation [11].

Reconstructive microsurgery for oral and maxillofacial cancer defects is considered as a niche specialty. With the advancement in reconstructive microsurgery it can be positively stated that microsurgery has come of age. Free radial forearm flap, anterolateral thigh flap and free fibula flap have been aptly termed as the workhorses of oral and maxillofacial reconstruction.

But now it is well known that with extensive resections a variety of functions may be affected which includes speech, deglutition, management of oral secretions and mastication. This in turn affects the quality of life of the patient and also return of normal pre disease life.

This study was designed to evaluate, in a prospective fashion, the return of normal pre disease life especially with specialised recovery programmes i.e., ERAS which reduces the total length of hospital stay & early return of normal activities post reconstruction with microvascular free flap as a primary endpoint in patients treated for oral cavity cancers and to improve the quality of life of the patient [12-15].

**Research Question**

Is there a beneficial effect on reduced hospital length of stay (LOS) for the patients undergoing free microvascular flaps under ERAS protocols? Is there any change is Flap related complications in ERAS group as compared to Traditional group.

## 2. Aims and Objectives

The aim of our study is to collect data of all the patients included in our study, to assess the total recovery of patients and to suggest further modifications for improvement in the quality of life of these patients.

1. **Primary Objective:** Is to evaluate Hospital Length of stay (LOS) after free flap surgery in ERAS group as compared to Traditional group.
2. **Secondary Objective:** To assess the evidence on the impact of enhanced recovery programme on flap related complications such as complete or partial flap loss compared to traditional care in patients undergoing free flap

surgeries.

**Benefits**

The implementation of ERAS protocols helps in a significantly minimizing hospital LOS and potentially decreases the use of resources as compared to traditional protocols.

The main benefit of ERAS protocol implication is that the direct medical and indirect non-medical costs were significantly reduced.

The implementation of an ERAS programme and costs involved in setting up and maintaining such an ERAS programme was much less compared to costs saved in reduced postoperative resource utilization like significant reduction in total hospital stay, intravenous fluid use, complications and duration of epidural use in the ERAS group.

**Adverse Effects**

There are no adverse effects of this study as it is an observational study and follow up assessment is a part of routine care.

**Material and Methods**

**i) Study Site:** Inpatients in a tertiary care referral hospital.

**ii) Study Population:** All patients who will be undergoing free flap reconstruction by standard technique Anterolateral thigh free flap/Radial artery forearm flap/Free fibula flap +/- modification with ERAS protocol application will be included in the study.

**iii) Study Design:** Prospective observational study.

**iv) Sample Size:** The sample size for 95% Confidence level & 80% power works out 31 per group.

**v) Study Duration:** This prospective study will be conducted between January 2017 to April 2018.

**vi) Inclusion Criteria:** All Patients undergoing free micro-vascular free flaps for H&N malignancies are included in study.

**vii) Exclusion Criteria:** All patients undergoing Tracheostomy in ERAS as well as in Traditional group (non-ERAS) during intra operative period.

**viii)** Methodology

All patients having free flap reconstruction for head and neck cancer entered into the ERAS protocol between January 2017 to April 2018 were included in the analysis.

In Traditional group (non-ERAS) historical cases i.e., patients who have undergone free flap reconstruction for head and neck cancer prior to January 2017 who did not follow any formal recovery programme were included.

All patients who will be undergoing free flap reconstruction by standard technique (Anterolateral thigh free flap/Radial artery forearm flap/Free fibula flap +/- modification) with ERAS protocol application will be included in the study.

**Pre-Operative Phase**

Begins with appropriate patient counseling, selection, and preparation during their preoperative visits in OPD which brings up the concept of prehabilitation, which involves the assessment of patients for surgery and optimization of comorbid conditions before definitive repair. We set few criteria's to be included in this phase

1. All patients were admitted prior to the day of surgery.
2. Patients are provided with information regarding the protocol.
3. Patients were told about what can typically be expected to occur at different time points before and after their surgery.
4. Informed and written consent was taken.
5. Patient should have a Hb of >/= 10g% + Hematocrit of >/= 30%.
6. Usage of tobacco in any form to be stopped at least 2 weeks prior to surgery (preferable).
7. Pre warming of patient-Pre op use Baer Hugger/Patient warmer and during transport to operation theatre use blankets to keep the patient warm.
8. Pharmacological prophylaxis of postoperative nausea or vomiting.
9. Pre-emptive analgesia initiated before surgery.
10. Antibiotic prophylaxis.

**Intra-Operative Phase**

This phase aims to minimise the physiological stresses associated with surgery. Intra- operative stroke volume variation cardiac output monitoring (Flotrac; Edwards Life Sciences) is used to facilitate goal-directed intra-operative fluid therapy and prevent under or overfilling.

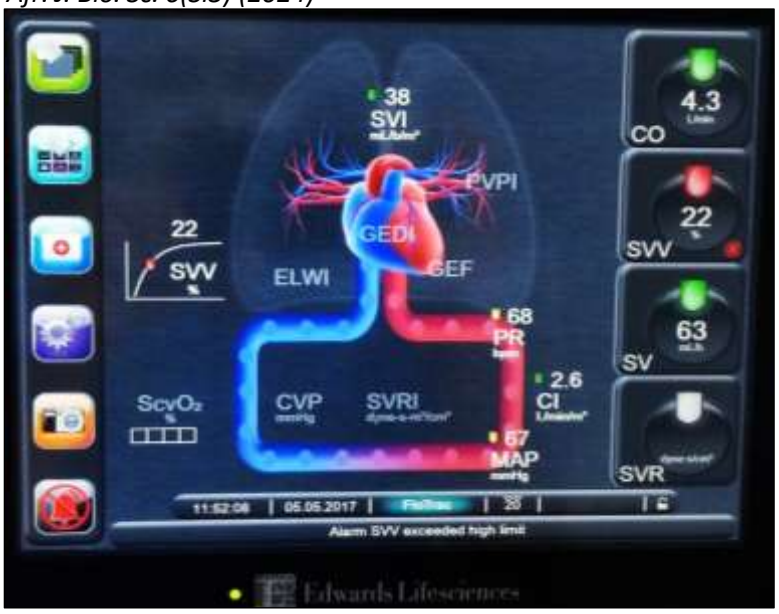


**FIGURE 1.1:** FLOTRAC EDWARDS LIFE SCIENCES CARDIAC OUTPUT MONITOR

**Flotrac; Edwards Life Sciences**

Free tissue transfer is complex and success is dependent on a number of factors including careful management of perioperative fluids. Too much fluid can result in a flap being compromised or even failing. Traditional methods of intra-operative fluid measurement utilised central venous pressure (CVP) and mean arterial pressure (MAP) monitoring, but these methods may not accurately guide fluid replacement.

Haemodynamic monitoring using Flotrac; Edwards Life Sciences, (stroke volume variation cardiac output monitoring) is more accurate and has been shown to speed up postoperative recovery, result in a shortened postoperative stay in hospital and a re-duction in postoperative complications.

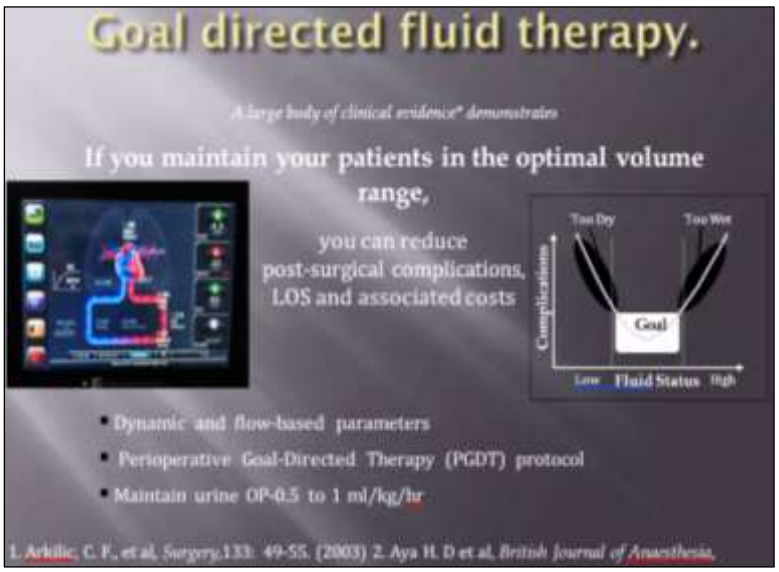


**FIGURE 1.2:** GOAL DIRECTED FLUID THERAPY TO MAINTAIN OPTIMAL VOLUME RANGE DURING SURGERY

Other measures taken to reduce physiological insult include maintenance of normothermia, use Infiltration of all incisions with local anesthetic & avoidance of drains.

**Post Operative Phase:**
Patients are routinely sedated and ventilated overnight in the ICU, and extubated the next morning.
**On the <u>POD1:</u>** Extubated.
Out of bed/Mobilise (if patient tolerates).
Enteral feeding starts (through NGT)/Minimize IVF Transfer to head and neck ward.
Chest physiotherapy (daily).
**<u>POD2</u>:** Mobilise for increased distance twice daily Increase rate of enteral feed.
Remove urinary catheter.

**POD3:** Independently mobile Full nutritional requirement through NGT Speech & Language assessment reference.
**POD4:** Start sips of water building up to free fluids if safe to swallow Consider removal of neck drain if <30 ml/24 hours

Speech & Language assessment review
**POD 5:** Start pureed diet.
**POD 6:** Continue pureed diet.
**POD 7:** Consider suture removal (Neck/Donor site) Remove NGT.

Plan for discharge
**POD 8:** Discharge

**Follow-Up Visits after Discharge:** Twice at 15 day and 30 day for assessment of flap (no flap loss/partial loss/complete loss)

**ix) Method of Measurement of Outcome of Interest:**

Total Hospital LOS in ERAS group-

Total Hospital LOS in traditional (non-ERAS) group-Flap related complications in ERAS group-

Flap related complications in traditional (non-ERAS) group-

**x) Data Collection Methods: Data will be collected when patient is admitted in floor/day care for planned surgery under ERAS protocol.**

**Sample Size Calculation:**

The objective of the study is to compare the length of stay in ERAS group as compared to Traditional group.

The formula used is as under:

$n = (\sigma 12 + \sigma 22)\ (Z\alpha + Z\beta)2/(\Delta 1 - \Delta 2)2$

Where,

n = Sample Size

Zα = Value of standard normal variate corresponding to α level of significance Zβ = The standard normal deviate for desired power

Δ = Average Change

σ = Standard deviation of Change

**Assumptions:**

Parameter of Interest: Length of Stay.

Mean value of the parameters for ERAS group (Δ1) = 8.0 Mean value of the parameters for Traditional group (Δ2) = 10.2 Coefficient of variation = 30%

Standard deviation of the parameters for ERAS group (σ1) = 2.4 Standard deviation of the parameters for Traditional group (σ2) = 3.6 Difference in the parameters for two groups (Δ) = (Δ1 – Δ2) = 2.2

Zα = Value of the standard normal variate corresponding to desired level of significance α (1.96 for α = 0.05)

Zβ= Value of the standard normal variate corresponding to desired power (0.84 for 80% power)

(Source for Δ1, Δ2, etc[16])

With the above assumptions the sample size for 95% confidence level & 80% power works out 31 per group.

**Statistical Analysis Plan:**

The analysis will be included profiling of patients for both the groups on different demographic and clinical parameters. Descriptive analysis of quantitative data will be expressed as means and standard deviation. Cross tables will be generated and chi square test will be used for testing of associations. Independent Student t- test was used for comparison of individual quantitative parameters between groups and paired t – test for within the group. P-value < 0.05 is considered statistically significant. SPSS software, version 24.0 will be used for statistical analysis.

**Confidentiality**

The name and identity of the patient will not be disclosed anywhere. No publications will identify the patient.

**Ethical Consideration**

It must be noted that the clearance of the research proposal by the Ethics Committee is compulsory for all the studies including the ones without Interventions. Institutional ethical committee approval and informed written consent from all patients was taken.

**Outcome Measures (Primary and Secondary)**

The primary end point was total hospital LOS, defined as the number of days from patient admission to the hospital until discharge including ICU stay. For all patients, POD 0 was defined as the day of operation.

The secondary end points were postoperative outcomes and complications, defined as those occurring at any time from initiation of reconstruction up to 30 postoperative days. Major complications, within 30 days of the index operation, were defined as any hospital readmission, partial or complete flap loss, unplanned reoperation for any reason, deep vein thrombosis, or pulmonary embolism. Unplanned readmissions were those occurring within 30 days of the date of discharge from the index admission and were linked to the relevant index admission. Unplanned reoperations were defined as any unscheduled surgery after the index operation and related to the index admission. Flap loss was defined as complete loss of the flap due to microvascular arterial or venous thrombosis requiring re-exploration. Partial flap loss was defined as a loss of less than approximately 40% of the total flap volume due to intravascular flap characteristics that did not support that particular area of the flap.

**Observations and Results**

32 patients in ERAS group underwent simultaneous microvascular flap reconstruction post resection for oral cavity malignancy in a tertiary care referral hospital during a period of one year.

These patients were compared to non-ERAS group who had undergone free flap reconstruction for head and neck cancer prior to January 2017 & who did not follow any formal recovery programme.

**TABLE 1:** THE AGE DISTRIBUTION OF PATIENTS IN THE STUDY GROUP

| Age | Non-ERAS | Non-ERAS | ERAS | ERAS |
|---|---|---|---|---|
| **<60 yr** | 14 | 43.8% | 22 | 68.8% |
| **>60 yr** | 18 | 56.3% | 10 | 31.3% |

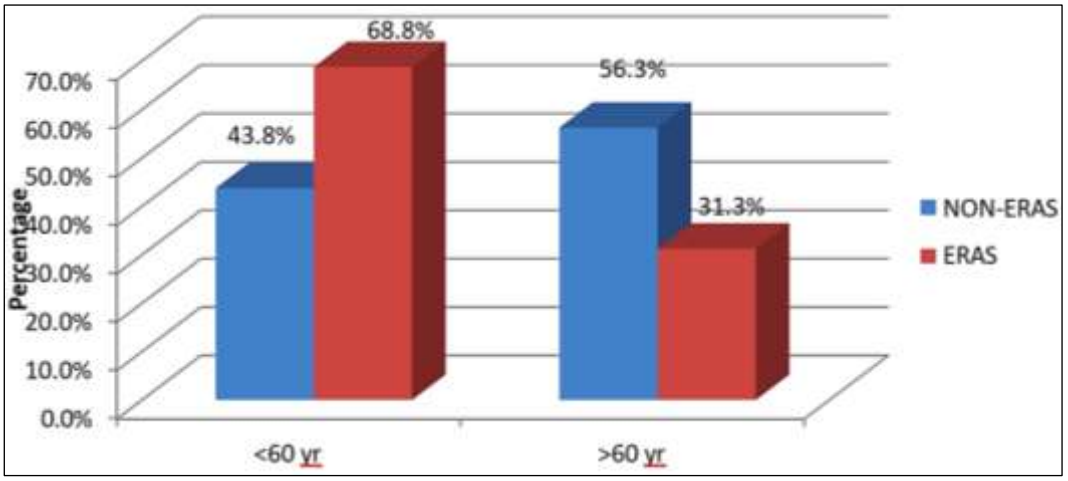


**FIGURE 2.1:** BAR CHART SHOWING AGE DISTRIBUTION IN NON-ERAS AND ERAS GROUP

Age categorization done in 2 groups with <60 yrs and >60 yrs. In non-ERAS 44% of patients belong to < 60 years & 56 % of patients belong to > 60 years where as in ERAS group 69% of patients belong to < 60 years & 31% belong to > 60 years of age groups as depicted in above diagram.

**TABLE 2:** GENDER DISTRIBUTION OF PATIENTS IN STUDY GROUP

| Gender Groups | Male | % | Female | % |
|---|---|---|---|---|
| Non-ERAS group | 25 | 78.1 | 7 | 21.8 |
| ERAS group | 30 | 93.7 | 2 | 6.25 |

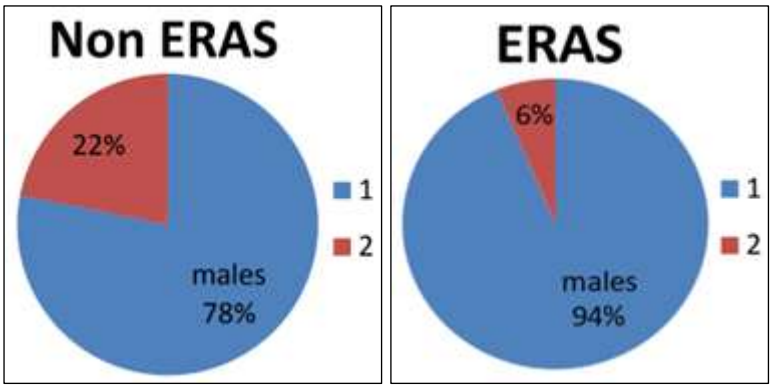


FIGURE 2.2: PIE CHART SHOWING GENDER DISTRIBUTION IN NON-ERAS AND ERAS GROUP

Although the gender distribution was not significant to the study conducted, male preponderance (non-ERAS=78%, ERAS=94%) in both groups validates increased occurrence of oral cancer in males [17].

**Clinical Diagnosis**

**TABLE 3:** SITES OF TUMOR INVOLVEMENT ON CLINICAL EXAMINATION

| Tumor | Non-ERAS | | ERAS | |
|---|---|---|---|---|
| **Floor of mouth& tongue** | 3 | 9.4% | 2 | 6.3% |
| **Mandible** | 23 | 71.9% | 24 | 75.0% |
| **Maxilla** | 8 | 25.0% | 12 | 37.5% |
| **Lip/cheek** | 20 | 62.5% | 20 | 62.5% |
| **Palate** | 2 | 6.3% | 2 | 6.3% |

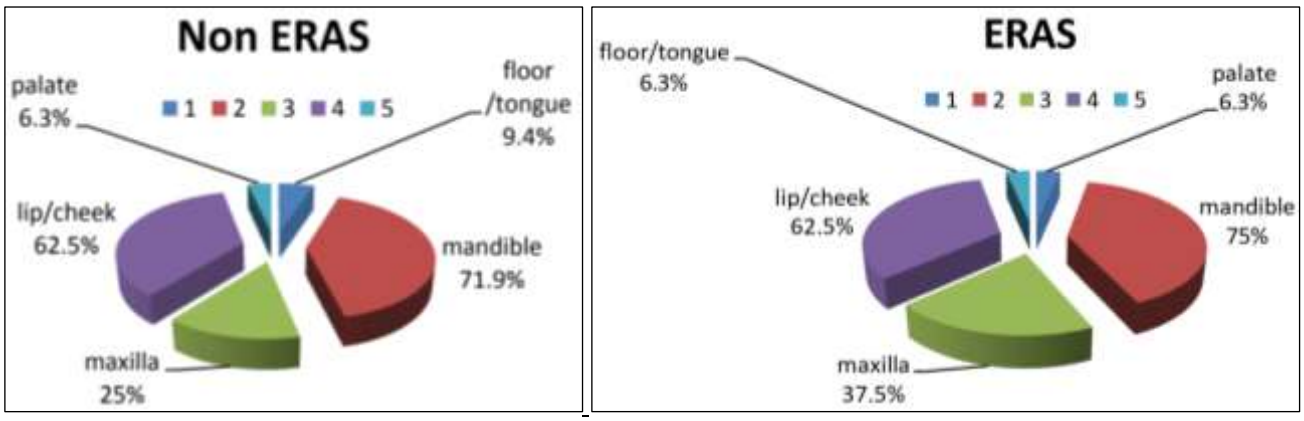


**FIGURE 3.1:** PIE CHART SHOWING SITES OF TUMOR INVOLVEMENT ON CLINICAL EXAMINATION

Majority of patients had lesion involving buccal mucosa (62.5%) and mandible (71%-75%) in both groups. Lesion involving maxilla were 25% in non-ERAS group and 37.5% in ERAS group. Lesions involving palate and floor of mouth with tongue constituted 6 to 9% in oth groups.

**Personal Habits:**

Tobacco consumption in any form which includes-smoking, chewing, both.

**TABLE 4A:** HISTORY OF TOBACCO CONSUMPTION

| | Non-ERAS | % | ERAS | % |
|---|---|---|---|---|
| **h/o tobacco** | 22 | 68.8% | 23 | 71.9% |

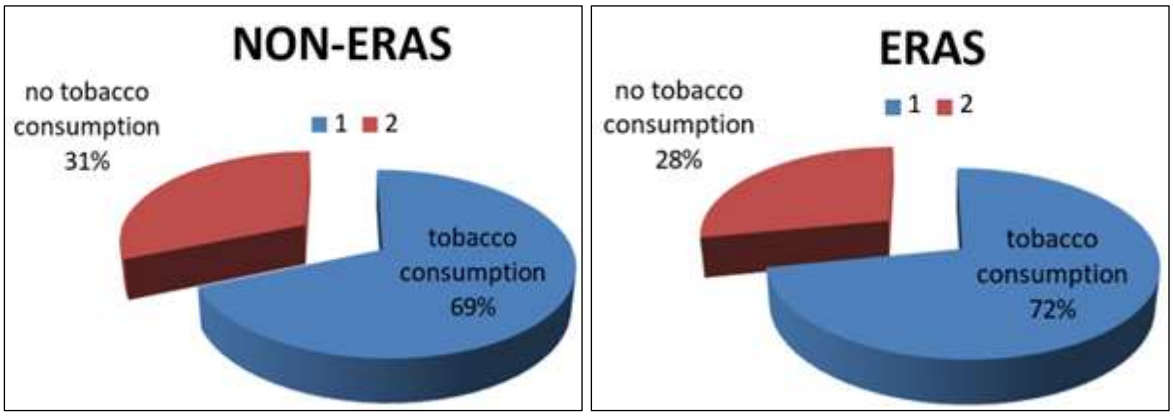


**FIGURE 4A:** PIE CHART SHOWING CATEGORIZATION OF TOBACCO CONSUMPTION

In both the groups ~68 to 72% patients gave h/o tobacco consumption which indicates tobacco consumption is a leading cause of cancer in oral cavity [10].

**TABLE 4B:** HISTORY CO-MORBID CONDITIONS

| Co morbidities | Group | | | |
|---|---|---|---|---|
| | Non-ERAS | | ERAS | |
| HTN | 1 | 3.12% | 5 | 15.60% |
| DM | 1 | 3.12% | 3 | 9.37% |
| CAD | 0 | 0.00% | 0 | 0.00% |
| HTN+DM | 7 | 21.87% | 3 | 9.37% |
| HTN+DM+CAD | 2 | 6.25% | 0 | 0.00% |
| DM+CAD | 0 | 0.00% | 0 | 0.00% |
| HTN+CAD | 1 | 3.12% | 1 | 3.12% |
| None | 20 | 62.50% | 20 | 62.50% |

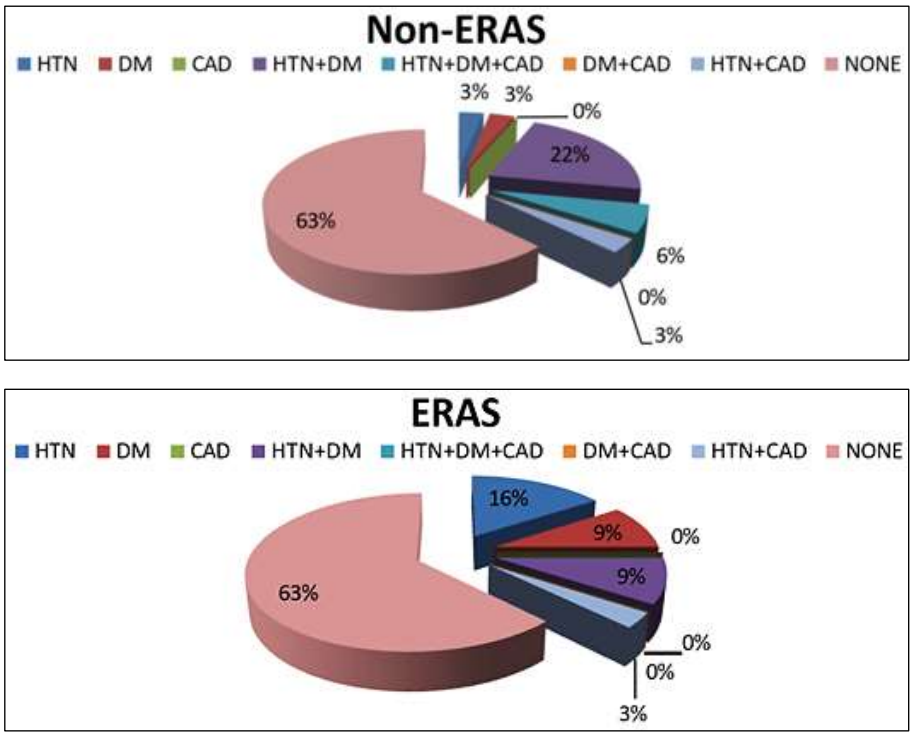


FIGURE 4B: PIE CHART SHOWING DISTRIBUTION OF CO-MORBID CONDITIONS IN BOTH GROUPS

In both groups 63% of patients did not had any co-morbid conditions however segregation of co-morbid conditions has been assorted and portrayed in above table & pie chart.

**Procedure Details**

Oral composite resection was performed by the head & neck oncosurgeon. Intraoperative tumor mapping was done and resultant resection involving various compartments of the oral cavity are tabulated as follow:

**TABLE 5:** INTRA OPERATIVE SITES OF RESECTION

| Tumor | Non-ERAS | Non-ERAS | ERAS | ERAS |
|---|---|---|---|---|
| Floor of mouth & tongue | 3 | 9.4% | 2 | 6.3% |
| Segmental | 16 | 50.0% | 13 | 40.6% |
| Marginal | 7 | 21.9% | 11 | 34.4% |
| Maxillectomy | 8 | 25.0% | 12 | 37.5% |
| Lip/cheek | 20 | 62.5% | 20 | 62.5% |
| Palate | 2 | 6.3% | 2 | 6.3% |

In both groups buccal mucosa resection was done in 20 patients each. 16 and 13 patients in non-ERAS & ERAS group underwent segmental mandibulectomy respectively. 7 patients in non-ERAS group underwent marginal mandibulectomy whereas 11 patients in ERAS group underwent marginal mandibulectomy. Maxillectomy was done in 8 & 12 patients in ERAS & non-ERAS group respectively. Glossectomy + floor of mouth resection done in 3 patients of non-ERAS group and 2 in ERAS group. WLE of palate done in 2 patients in both groups.

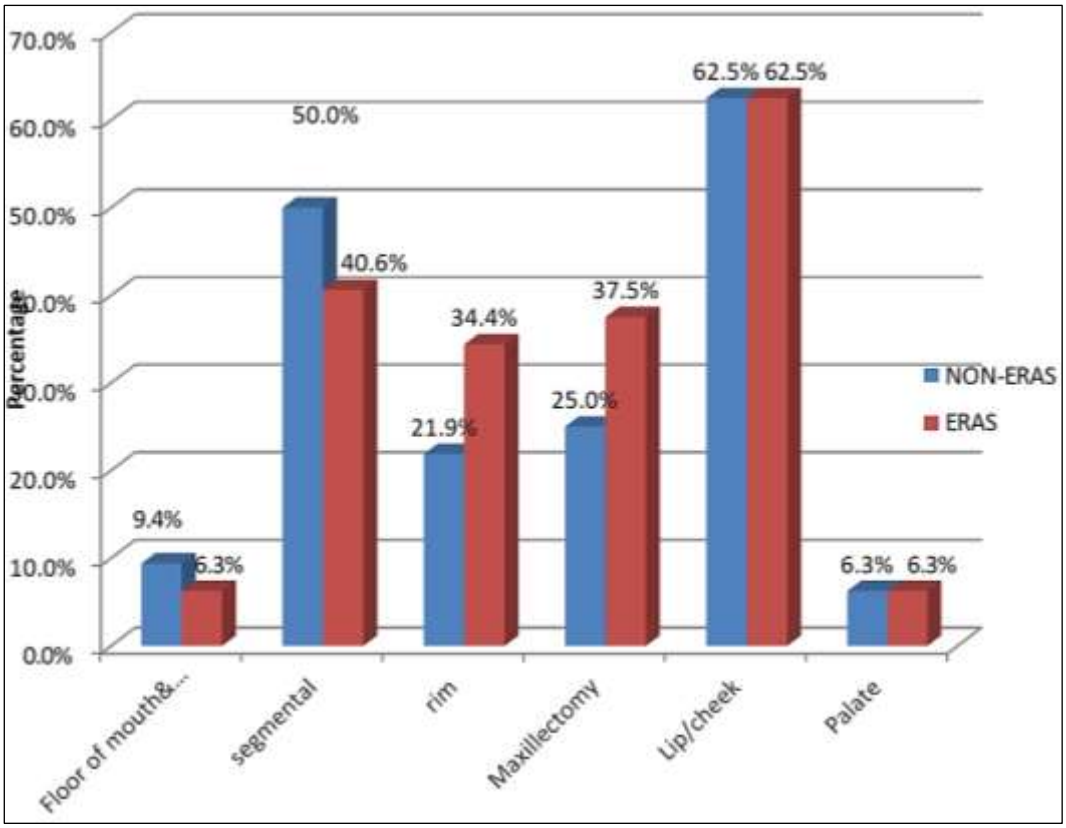


**FIGURE 5:** BAR CHART SHOWING CATEGORIZATION OF NUMBER & PERCENTAGE OF TUMOR RESECTION

To simplify the study and for better understanding we divided resection types into 2 category as shown in below table.

**TABLE 6:** TYPE OF RESECTION DONE IN NON-ERAS AND ERAS GROUP

| Resection | Non-ERAS | Non-ERAS | ERAS | ERAS |
|---|---|---|---|---|
| Soft Tissue | 6 | 18.8% | 5 | 15.6% |
| Bone | 26 | 81.3% | 27 | 84.4% |

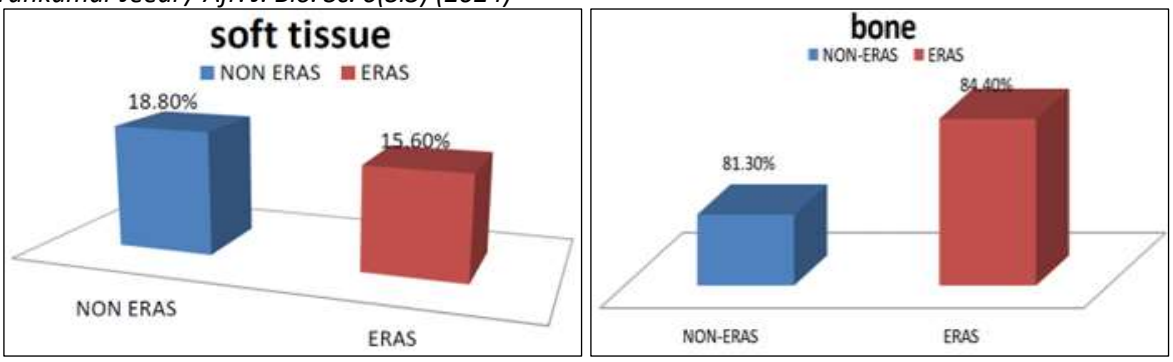


**FIGURE 6:** TYPE OF RESECTION DONE IN NON-ERAS AND ERAS GROUP

Bony resection was done in 26(81.3%) patients in non-ERAS and 27 patients (84.4%) in ERAS group out of 32 patients. Soft tissue resection was done in 6 and 5 patients in non-ERAS and ERAS groups respectively.

Once resection was complete, defect was reconstructed with microvascular free flap.

**TABLE 7:** RECONSTRUCTIVE TECHNIQUE

| Flap | Non-ERAS | Non-ERAS | ERAS | ERAS |
|---|---|---|---|---|
| **ALT** | 23 | 71.9% | 23 | 71.9% |
| **Free fibula** | 6 | 18.8% | 7 | 21.9% |
| **RAFF** | 3 | 9.4% | 3 | 9.4% |

23 patients out of 32 in study population underwent ALT free flap in both groups. 6 patients underwent vascularised free fibula flap in non-ERAS whereas 7 in ERAS group. 3 underwent Radial artery free flap in each groups. In ERAS group 1 patient underwent additional ALT free flap along with vascularised free fibula flap in same setting.

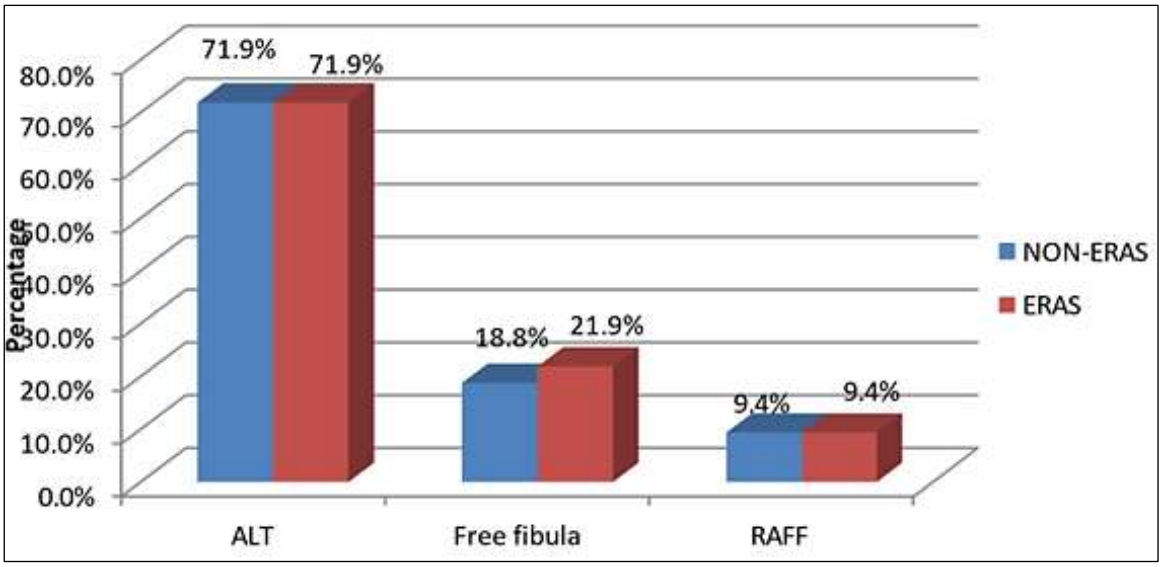


**FIGURE 7:** BAR CHART SHOWING RECONSTRUCTIVE TECHNIQUES

**Intra Operative Period:** During this period patients in ERAS group were given IV fluids based on stroke volume variation cardiac output monitoring which is assessed by flotrac machine. The parameters of interest are as depicted in below charts.

**TABLE 8:** USE OF CRYSTALLOIDS AND COLLOIDS IN BOTH GROUPS

| Group | Non-ERAS | | ERAS | | p-value |
|---|---|---|---|---|---|
| IVF-crystalloids used intraop (ml) | Mean 3012.50 | SD 635.38 | Mean 2721.88 | SD 1036.35 | 0.198 |
| Colloids-intra-op (ml) | Mean 446.88 | SD 196.72 | Mean 564.38 | Mean 296.49 | 0.256 |

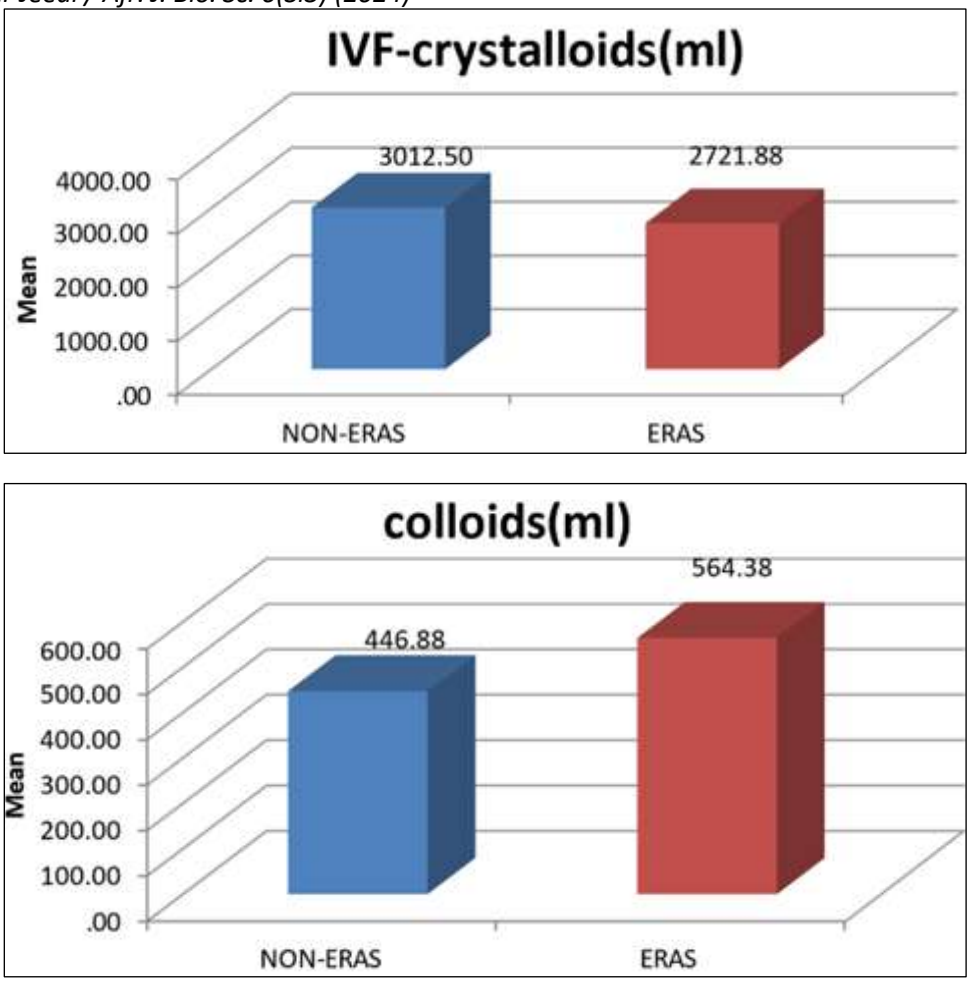


**FIGURE 8:** BAR DIAGRAM SHOWING IVF AND COLLOIDS USED IN NON-ERAS AND ERAS GROUPS

The mean crystalloids used in non-ERAS group is 3012 ml as compared to 2721 ml in ERAS group. The mean colloids used in non-ERAS group is 446 ml as compared to 546 ml in ERAS group.

**TABLE 9:** USE OF INTRA OP ANTICOAGULATION IN BOTH GROUPS

| | | GROUP | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Non-ERAS** | **Non-ERAS** | **LOS** | **ERAS** | **ERAS** | **LOS** | **P value** |
| Intraop anticoagulation | No | 30 | 93.8% | | 26 | 81.3% | | |
| | Yes | 2 | 6.3% | 10-15d | 6 | 18.8% | 8-13d | 0.712 |

In view of increased thrombogenic potential in some patients intra op anticoagulation was used. Low molecular heparin (Deltaparin, Fragmin) at a dose of 2500 international units given subcutaneous as a single stat dose. In non-ERAS group there were 2 patients who required anticoagulation and in ERAS group 6 patients needed anticoagulation during intra op period.

Anticoagulation was continued in post op period in these patients for 5 days period with overlapping or oral anticoagulation (Ecosprin) on 3rd day.

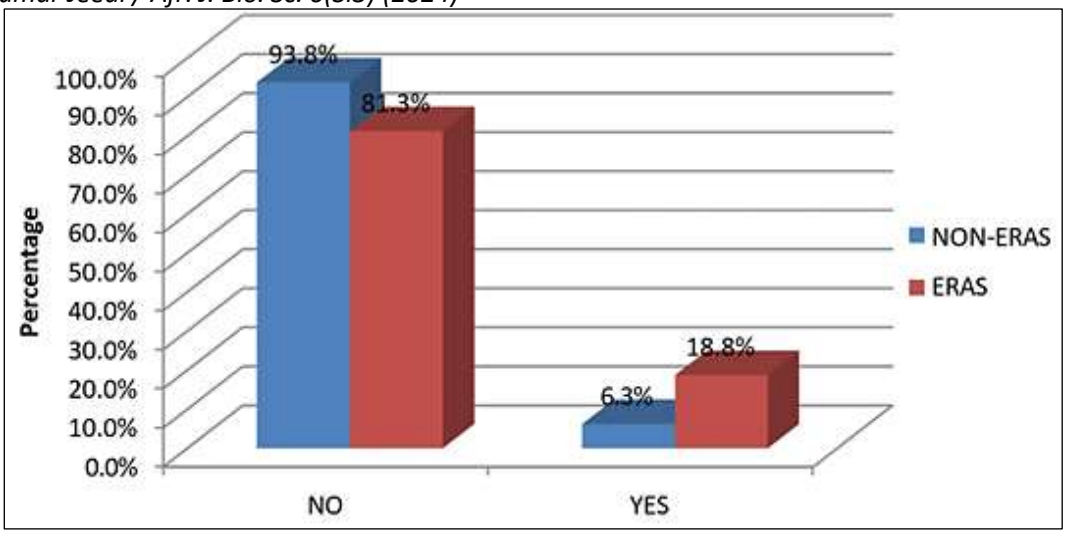


**FIGURE 9:** BAR DIAGRAM SHOWING USE OF INTRA OP ANTICOAGULATION IN BOTH GROUPS

In post operative period 2 more patients in each group needed anticoagulation.

**TABLE 10:** USE OF POST OP ANTICOAGULATION IN BOTH GROUPS

| | | Group | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | **Non-ERAS** | **Non-ERAS** | **LOS** | **ERAS** | **ERAS** | **LOS** | **P value** |
| Postop Anticoagulation | No | 28 | 87.5% | | 24 | 75.0% | | |
| | Yes | 4 | 12.5% | 10-15d | 8 | 25.0% | 8-13d | 0.682 |

On comparing LOS in patients who received intra op and/or post op anticoagulation between non-ERAS and ERAS group, study shows in non-ERAS group LOS was 10- 15 days but in ERAS group LOS was 8-13 days. Even though the LOS was shorter in ERAS group the difference was not statistically significant(p-0.682)

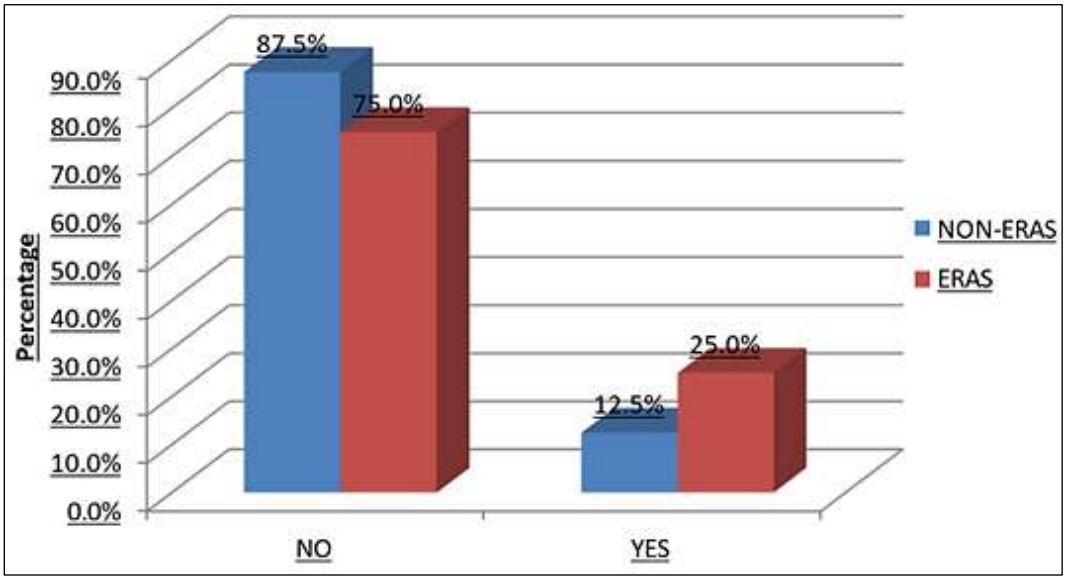


**FIGURE 10:** BAR DIAGRAM SHOWING USE OF POST OP ANTICOAGULATION IN BOTH GROUP

**Post Op Period:** The parameters assessed in post operative period are ICU stay, Opioid usage in post op period.

**TABLE 11:** SHOWING POST OPERATIVE PARAMETERS-MEAN ICU STAY AND OPIOID USAGE IN POST OPERATIVE PERIOD IN 2 GROUPS

| **Group** | **Non-ERAS** | | **ERAS** | | **p-value** |
|---|---|---|---|---|---|
| ICU stay(hrs)-post op | Mean 51.25 | SD 22.67 | Mean 42.97 | SD 3.11 | 0.003 |
| Opiod usage in post op period(hrs) | Mean 13.50 | SD 11.23 | Mean 9.25 | SD 1.59 | 0.005 |

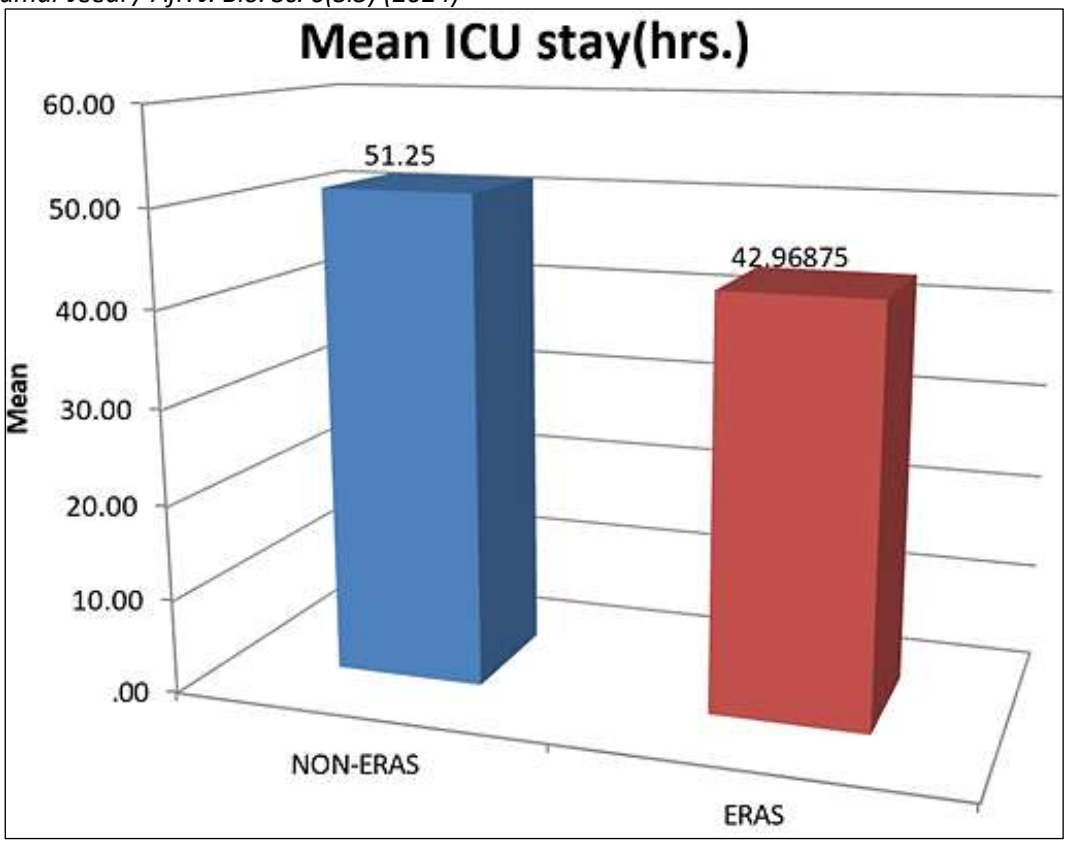


**FIGURE 11:** BAR DIAGRAM SHOWING MEAN ICU STAY IN NON-ERAS & ERAS GROUPS

The mean ICU stay in non-ERAS group is 51.25 hours as compared to 42.97 hours in ERAS group and the difference is statistically significant (P =0.003).

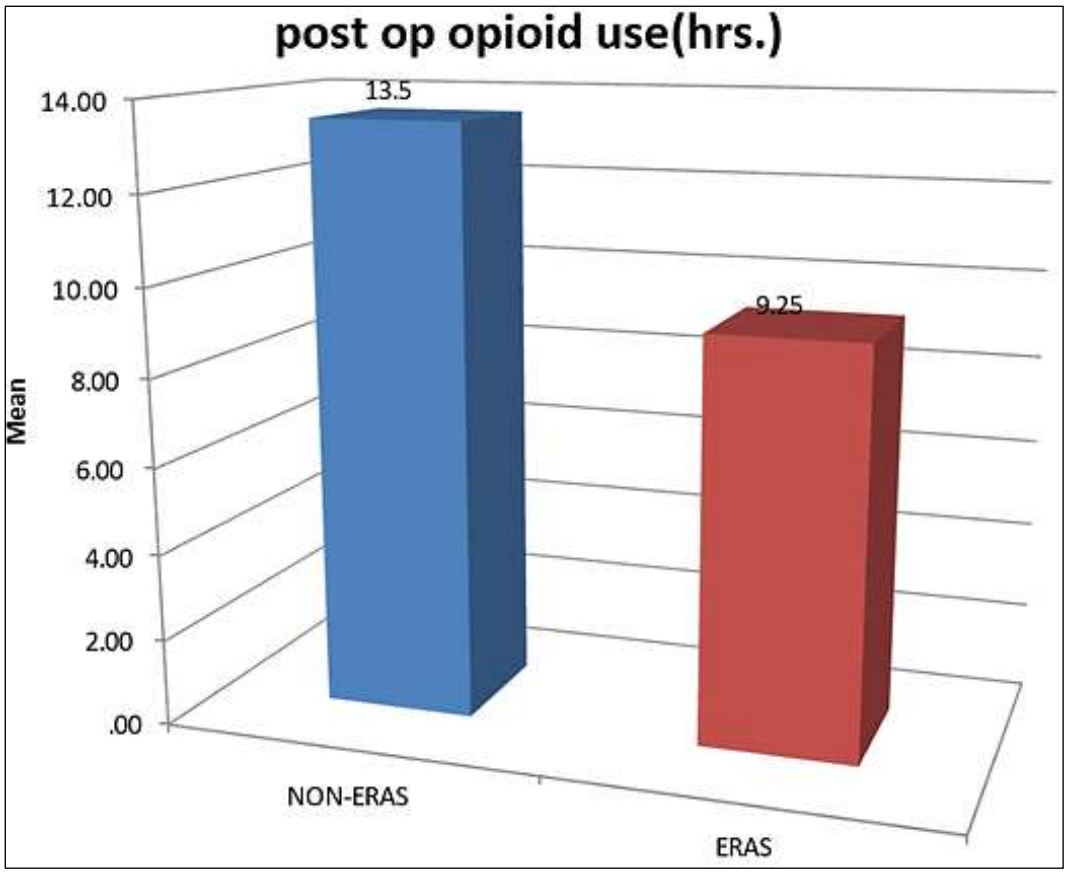


**FIGURE 12:** BAR DIAGRAM SHOWING OPIOID USAGE IN NON-ERAS & ERAS GROUPS

The post operative opioid usage is for ~ 14 hours & 9.25 hours in non-ERAS & ERAS group respectively and the difference is statistically significant (P -0.005).

Once patients shifted to ICU, IVF were given at 100 to 120 ml/hr rate so as to maintain urine output of 70 to 80 ml/hr till next day morning.

**TABLE 12:** SHOWING INSIGNIFICANT POST OPERATIVE PARAMETERS OF 2 GROUPS

| | Non-ERAS | | ERAS | | | |
|---|---|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** | **Z** | **p-value** |
| **Pain score (out of 10)** | 3.88 | 1.26 | 3.56 | 1.27 | -0.925 | 0.355 |
| **RT feed started on (POD)** | 1.00 | 0.00 | 1.00 | 0.00 | 0.000 | 1.000 |
| **IVF stop (after extubation)-hrs** | 12.00 | 0.00 | 12.00 | 0.00 | 0.000 | 1.000 |
| **Foley's re-moved (POD)** | 2.00 | 0.00 | 2.00 | 0.00 | 0.000 | 1.000 |
| **Out of bed (POD)** | 1.00 | 0.00 | 1.00 | 0.00 | 0.000 | 1.000 |
| **Ambulate (POD)** | 2.19 | 0.59 | 1.88 | 1.21 | -2.965 | 0.003 |

In our study the stroke volume variation cardiac output monitoring (flotrac) was restricted to intra operative period only. In the post op recovery period activities remained same for both groups. Patients were extubated next day morning i.e., 12 hours after surgery. IVF tapering and stopping is equilibrated with Ryle's tube feeding which is started on POD 1(i.e., 12 hours after surgery). Starting from 12 hours after surgery (next day morning) IVF is reduced to75 ml/hr along with beginning of RT feeds which is started at 25 ml/hr for initial 4 hours following which IVF reduced to 50 ml/hr + RT feeds increased to 50 ml/hr for next 4 hours. Likewise, IVF are stopped after another 8 hour's time while RT feeds will be at a rate of 100 ml/hr. Meanwhile patients are made out of bed in ICU's on POD1. Patients were shifted to rooms on POD2 and were made to ambulate. Foley's catheter is removed after 48 hours on POD2.

There were no statistical significance between pain score (examined by visual analogue score), Ryle's tube feeding start time, foley's removal, out of bed. However, there is a statistical significance between 2 groups with regard to ambulate in post operative period. (p-0.003).

**TABLE 13:** SHOWING TOTAL LENGTH OF STAY IN 2 GROUPS

| | Non-ERAS | | ERAS | | | |
|---|---|---|---|---|---|---|
| | **Mean** | **SD** | **Mean** | **SD** | **Z** | **p-value** |
| **LOS in hospital (Days)** | 11.06 | 2.26 | 8.84 | 1.53 | -4.359 | <0.001 |

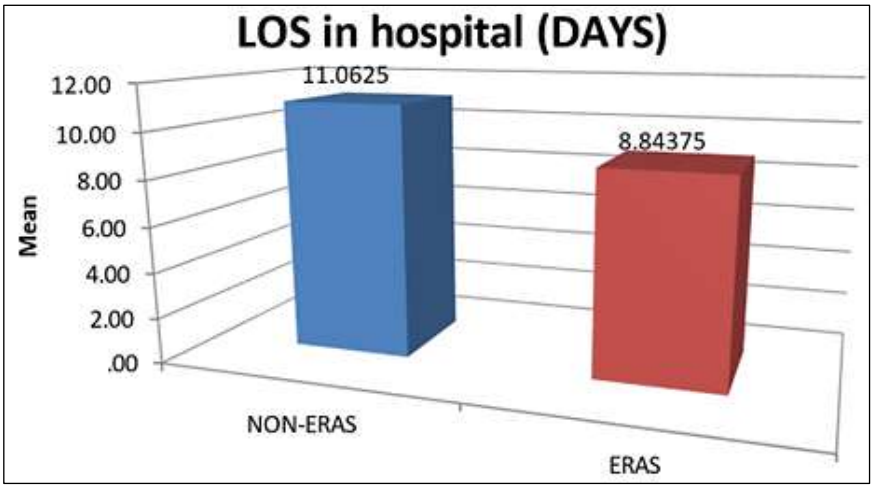


**FIGURE 13:** BAR DIAGRAM SHOWING LENGTH OF STAY (LOS) IN BOTH GROUPS

Out of 32 patients each in both groups the mean hospital length of stay in non-ERAS is 11.06 days where as its 8.84 days in ERAS and the difference is statistically significant (P-<0.001).

**TABLE 14:** OVERALL PATIENT'S LENGTH OF STAY IN 2 CATEGORIES OF AGE IN NON-ERAS AND ERAS GROUP

| **Age** | **Non-ERAS** | **LOS** | **ERAS** | **LOS** | **p-value** |
|---|---|---|---|---|---|
| **<60 yr** | 14 | (9-14d) | 22 | (7-13d) | 0.009 |
| **>60 yr** | 18 | (9-17 d) | 10 | (7-12d) | 0.002 |

With age categorization of < 60 years and > 60 years in both groups and in comparison, to length of stay in both category it's clear that length of stay in ERAS group is less compared to non-ERAS group with significant P Value of 0.009/0.002. This suggests in both category of age (< 60 yrs & > 60 yrs) groups under ERAS programme length of stay is significantly shorter as compared to non-ERAS group.

Within the ERAS group we compared the LOS between two age categories and it dipicts the LOS in both age groups is between 7 to 12/13 days and the difference is statistically not significant.

**TABLE 15:** OVERALL PATIENT'S LENGTH OF STAY IN COMPARISON WITH TYPE OF RESECTION IN NON-ERAS AND ERAS GROUP

| Resection | Non-ERAS | LOS | ERAS | LOS | p-value |
|---|---|---|---|---|---|
| **Soft Tissue** | 6 | 9-15d | 5 | 8-11d | 0.501 |
| **Bone** | 26 | 9-17d | 27 | 7-13d | <0.001 |

Assessment of length of stay in both groups with regard to type of resection i.e., soft tissue resection and bony resection indicates that, in non-ERAS group there were 6 patients who underwent soft tissue resection with LOS of 9-15 days as compared to 5 patients in ERAS group with LOS of 8-11 days which suggests LOS in ERAS group is short.

There were 26 patients each in non-ERAS group who underwent bony resection with LOS of 9-17 days and in ERAS group there were 27 patients who underwent bony resection with LOS of 7-13 days which shows that LOS in ERAS group is shorter and the difference is statistically significant (P value-<0.001).

| ERAS | Number | LOS | Mean (SD) | P value |
|---|---|---|---|---|
| Soft tissue resection | 5 | 8-11d | 9.20(1.30) | 0.811 |
| Bony resection | 27 | 7-13d | 9.37(1.47) | |

We studied the LOS within ERAS between soft tissue resection group & bony resection group with independent t test. Patients who underwent soft tissue resection (n=5) in ERAS group mean LOS was 9.20 days with standard deviation of 1.30 days. In patients who underwent bony resection (n=27) mean LOS was 9.37 days with standard deviation of 1.47 days and the difference is statistically not significant (p-0.811). However, study shows the duration of stay in bony resection group is slightly longer.

**TABLE 16:** OVERALL PATIENT'S LENGTH OF STAY IN RELATION WITH SITE OF TUMOR & EXTENT OF RESECTION IN NON-ERAS AND ERAS GROUP

| Tumor | | Non-ERAS | LOS | ERAS | LOS | p-value |
|---|---|---|---|---|---|---|
| **Floor of mouth& tongue** | | 3 | 9-17d | 2 | 10-11d | 0.564 |
| **Mandible** | Segmental | 16 | 9-17d | 13 | 8-13d | **0.012** |
| | Marginal | 7 | 9-14d | 11 | 7-8d | **<0.001** |
| **Maxilla** | | 8 | 9-12d | 12 | 7-11d | **0.012** |
| **Lip/cheek** | | 20 | 9-15d | 20 | 7-13d | **<0.001** |
| **Palate** | | 2 | 9-12d | 2 | 9-11d | 0.683 |

The above table shows comparison of length of stay in relation with site of tumor or extent of resection in both Non-ERAS and ERAS groups. The LOS in ERAS group of patients who had undergone segmental mandibulectomy (p-0.012), marginal mandibulectomy (p-<0.001), maxillectomy (p-0.012), buccal mucosa resection (p<0.001) is much shorter as compared to non-ERAS group and the difference is statistically significant.

**TABLE 17:** OVERALL PATIENT'S LENGTH OF STAY IN RELATION WITH FREE FLAP RECONSRUCTION IN NON-ERAS AND ERAS GROUP

| Flap | Non-ERAS | LOS | ERAS | LOS | p-value |
|---|---|---|---|---|---|
| **ALT** | 23 | 9-17d | 23 | 7-11d | <0.001 |
| **Free fibula** | 6 | 10-15d | 7 | 8-13d | 0.014 |

| | | | | | |
|---|---|---|---|---|---|
| **RAFF** | 3 | 9-10d | 3 | 8-11d | 0.817 |

In our study irrespective of free flap reconstruction it is evident that LOS is shorter in ERAS group with significant statistical difference (p-<0.001/0.104) in comparison with non-ERAS group.

**TABLE 18:** SHOWING FLAP RELATED COMPLICATIONS IN NON-ERAS AND ERAS GROUP

| | | Group | | | | Total |
|---|---|---|---|---|---|---|
| | | Non-ERAS | | ERAS | | |
| Flap related complication | **Dehiscence & wound infection** | 1 | 3.1% | 0 | 0.0% | 1 |
| | **None** | 29 | 90.6% | 29 | 90.6% | 58 |
| | **Re-exploration in 24h** | 0 | 0% | 1 | 3.1% | 1 |
| | **Re-expl on pod4** | 1 | 3.1% | 0 | 0.0% | 1 |
| | **Wound infection** | 1 | 3.1% | 0 | 0.0% | 1 |
| | **Dehiscence at flap suture line** | 0 | 0.0% | 1 | 3.1% | 1 |
| | **Intra op arterial revision in view of spasm** | 0 | 0.0% | 1 | 3.1% | 1 |
| | **Post op margins of flap discoloration/conservative Mx** | 0 | 0.0% | 1 | 3.1% | 1 |

The study shows re-exploration was required in 1 patient in both groups. Minor complications like dehiscence and wound infection occurred in 1 patient of non-ERAS group however in ERAS group 1 patient suffered with dehiscence of flap suture line. Intra op arterial revision was done in 1 patient in ERAS group in view of arterial spasm. Post op margin discolouration of flap occurred in 1 patient in ERAS group which was managed conservatively. On evaluating these findings there are no statistical significance between 2 groups in relation to flap related complications.

**TABLE 19:** SHOWING READMISSION RATES IN NON-ERAS AND ERAS GROUP

| | | Group | | | |
|---|---|---|---|---|---|
| | | Non-ERAS | | ERAS | |
| **Readmissn in 24 hrs after discharge** | NO | 32 | 100.0% | 32 | 100.0% |
| Total | | 32 | 100.0% | 32 | 100.0% |

There is no readmission within 24 hours in any groups and on assessing these findings it is evident that the ERAS protocols are beneficial to patients and does not have any adverse effects.

Follow-up visits after discharge- done twice at 15 days and 30 days showed no changes in flap.

**Statistical Analysis**

In the primary analysis we compared the duration of stay between the ERAS and Non-ERAS groups. Secondary outcomes included a comparison of complications, read- mission rates.

Patients' personal, clinical, and surgical variables were summarised descriptively and the categorical outcomes in the two groups were compared using the chi square or Fishers' exact test, as appropriate.

The three-way analysis of variance (ANOVA) was used to test the equality of the mean duration of hospital stay between the ERAS and Non-ERAS groups, adjusting for the influence of age (<60 and ≥60 years), site & type of resection (bone compared with soft tissue) and for type of free flap reconstruction

**Primary Outcome:** Duration of stay.

The ERAS group had a mean overall mean duration of stay of 8 (SD=1.53) days com-pared with that of the non-ERAS group of 11 (SD=2.26) days. The difference was significant (p = 0.000), and the details are given in table 13.

There was a significantly shorter mean (SD) duration of stay for patients who needed bone resection (p -<0.001), those over/less than 60 years of age (p-0.009/0.002) in the ERAS compared with the non-ERAS group. The mean (SD) duration of stay was also shorter for the ERAS group compared with the non-ERAS group for patients who had a soft tissue only resection.

The mean duration of stay was shorter for patients who underwent segmental or marginal mandibulectomy (p-<0.001/0.012), maxillectomy(p-0.012), wide local excision of buccal mucosa(p-<0.001) in ERAS group.

**Secondary Outcomes:** Complications, readmission rates.

There were no significant differences in either the complication or readmission rates between the ERAS and Non-ERAS groups.

**Discussion**

Malignant tumors of the head and neck often require complex, labor-intensive surgery such as composite oral cavity resections, skull base surgeries, or large pharyngectomy and/or laryngectomy resections, often in the setting of salvage surgery after failed at-tempts at radiation and chemotherapy. Free flap reconstruction is often required for extensive defects, thereby adding to the length and complexity of these procedures. These extended procedures require a coordinated multidisciplinary team to deliver care before, during, and after surgery.

Optimal perioperative patient care is of the utmost importance to ensure that the recovery period is efficiently and effectively managed in an effort to provide the best possible outcome for the patient. Enhanced Recovery After Surgery (ERAS) was introduced as a way of optimizing perioperative care for a variety of surgical procedures[18]. Initially ERAS recommendations were developed for patients undergoing colorectal surgery[19]; evaluation of these recommendations has shown that patients in whom the ERAS interventions are applied experience significant improvements in function after surgery[20]. In turn, when the ERAS guidelines are implemented, patients have demonstrated reduced morbidity and shorter length of hospital stay[20]. The ERAS protocols have revolutionized the way peri operative care is provided and measured. Multimodal perioperative care has been studied in many surgical specialties and has been shown to decrease hospital stay without a consequent increase in morbidity[3]. Our study was designed after a multidisciplinary review of each stage of the patient's treatment, included detailed preoperative, intraoperative, and postoperative care.

An ERAS protocols for head and neck cancer surgery with free flap reconstruction published numbers are less. However, we designed a protocol based on, an expert panel of head and neck clinicians (surgery, anesthesiology, critical care, and nutrition), working collaboratively in the field of ERAS developed a consensus-based ERAS protocol for the perioperative treatment of patients undergoing head and neck cancer surgery with free flap reconstruction. At some phases of pathway, due to paucity of literature specific to head and neck cancer surgery and free flap reconstruction we based several number of parameters and recommendations from data extrapolated from other patient populations, particularly those undergoing colorectal surgery.

In 2017 Dort J *et al*. came up with a consensus review and recommendations From the Enhanced Recovery After Surgery Society (http://www.erassociety.org) [18]. On correlation of our protocols with his article the consensus and recommendations were similar in all phases of perioperative care. The purpose of this protocol is to improve patient well-being in the postoperative period by reducing procedure-related morbidity and complications. Evidence from previous ERAS protocols suggest that implementation of this protocol will also improve efficiency of care, with improvements in overall resource use and cost of care [18]. We estimate that in our centre a patient with head and neck cancer who is being treated by free tissue transfer is likely to see different members of clinical staff during a week spent in hospital, some of whom may be involved in treating this type of patient for the first time. We therefore produced a programme that gave details of the progress expected for each patient daily, which could be put into action by all clinical staff, and which would not be compromised by the experience of any member of staff [21]. Our patients who followed the ERAS Pro-gramme had a median duration of stay of 8 days, compared with 11 days in the non-ERAS group. We think that this reduction is the result of comprehensive multidisciplinary attention to detail at every stage of the patients' care, which has produced marginal gains throughout. As the cost of an inpatient day in our hospital is roughly 10,000 Rs per day, this indicates a potential saving of Rs 30,000 to 50,000/patient.

European studies have quoted a median duration of stay for patients being treated with major resections for head and neck cancer at 24-26 days. A further study from the USA for a similar group of patients had a mean stay of 9 days for uncomplicated cases, and 16 days for complicated cases [21].

M Bater *et al*., showed in his study that patients under the age of 60 years had a simi- lar median duration of stay in both groups (TRAS 11 days; ERAS 10 days), while in the ERAS group there was a median duration of stay of 11 days in patients over 60 years, compared with 14 days in the TRAS group, which was significant. However, our study shows significant shorter duration of stay in ERAS group in both age groups (<60 yrs/>60 yrs).

It has been well documented that the chronological age should not be used as the main criterion when evaluating a patient for a microvascular head and neck reconstruction[22], and it is likely that in our ERAS group early anaesthetic input resulted in improved assessment of coexisting medical conditions and the selection of patients.

Many authors have reported that the duration of stay for patients given tracheostomies as part of major operations for head and neck cancer was increased by five days com- pared with a similar group of patients without tracheostomies [21]. However, in our study we excluded patients who had tracheostomy considering the fact that their hospitalization might get

prolonged in view of morbidities associated with tracheostomy itself and this would skew our primary out comes. Literature suggests active management of the tracheostomy in the form of early mobilization, intense chest physiotherapy, and timely deflation of the tracheostomy cuff, enables early decannulation in these patients, without a noticeable increase in the duration of their stay [21].

Another factor we didn't include in our ERAS programme is carbohydrate preload largely due to the risks of aspirations and its associated complications however many studies suggest carbohydrate preload limits their preoperative starvation and its associated discomfort and thirst, and also to reduce the insulin resistance that accompanies the stress response to operation. It has been reported that hyperglycaemia as a result of increased insulin resistance leads to heightened activation of the immune system, which increases the risk of infective complications 10-fold. Loading with carbohydrate sets metabolism in an anabolic state preoperatively, and reduces insulin resistance [21]. In our study none of the patients developed major infective complications hence we quote that flap related complications are of no significance in relation to non-ERAS group. This understanding concludes that setting up an ERAS programme is cost effective and beneficial to patients.

After free tissue reconstruction of the oral cavity, patients are traditionally given nothing by mouth for an arbitrary 1-2 weeks before oral intake is resumed. Concerns have been raised about the increased risk of an orocutaneous fistula if oral feeding is re-introduced early, as the use of the tongue and pharyngeal musculature is thought to place added stress on the suture line and food may contaminate the wound [21]. In our study the median time to sustained oral intake was 5 to 6 days for the non-ERAS group and 5 days for the ERAS group. Before oral feeding was restarted, all patients were judged by our speech and language therapists to be able to swallow safely. No patients in either group developed an orocutaneous fistula as a result of early feeding.

This infers ERAS programme has no effect on orocutaneous fistula in relation with oral feeding.

There was no difference in the overall morbidity between the two groups (table 17), although patients with no complications in the ERAS group had a significantly shorter duration of stay than those with no complications in the non-ERAS group. There was also no difference in the readmission rates between the two groups.

Through the use of an ERAS programme we have shown that it results in a reduction in the duration of stay in all its subgroups (Table 15, 16, 17). We aim to publish more extensive data in the future, and think that large multicentre trials are necessary to establish best practice.

**Conclusion**

Duration of stay for patients having major operations for head and neck cancer is likely to become an increasingly important outcome measure as healthcare costs and services continue to be rationalised. Major Head and neck surgical procedures with free flap reconstruction are among the most complex areas of surgical endeavor and require careful preoperative preparation, intraoperative care, and coordinated postoperative care. Although many centres around the world provide excellent care to head and neck cancer patients, there is still tremendous variation in the application of perioperative care elements provided to this patient population.

We collected and evaluated the best available evidence and using a formal consensus-based approach, formulated clear recommendations for the major elements of perioperative care in the major head and neck cancer patient population. We have adapted the recommendations, where appropriate, to better fit the needs of patients undergoing head and neck cancer surgery with free flap reconstruction and have used the considerable expertise of the working group to make those adaptations.

In our study patients under ERAS group had shorter overall length of stay as compared to non-ERAS group (p-<0.001). Patients with age less than 60 years as well as more than 60 years had shorter length of stay in ERAS group (p-0.009/0.002). With regard to type of resection (soft tissue or bony) patients who had bony resection stayed for less duration in ERAS group (p-<0.001). Although patients who required soft tissue resection had shorter stay in ERAS, statistical difference was not significant (p-0.501) which is mainly due to less sample size. Within ERAS group, patients who underwent bony resection had longer stay in relation to soft tissue resection group.

Our study also proves that patients who underwent segmental mandibulectomy (p-0.012), marginal mandibulectomy(p-<0.001), maxillectomy (p-0.012), buccal mucosa resection(p-<0.001) had much shorter length of stay as compared to non-ERAS group. Another important finding we obtained is that the total ICU stay (in days) and post operative duration of opioid required (in hours) in ERAS is shorter (p-0.003/0.005). All these parameters validate ERAS protocol will make up a collection of evidence-based practices that are implemented with the goal of improving the value of patient care and seek to standardize a framework for care of specific patients.

Considerable resources are consumed in the care of patients having free tissue transfer for head and neck cancer, and we think that an ERAS programme is safe and effective, potentially reducing duration of stay in hospital as well as reduce

the resource utilization.

**Limitation of Study**

Our fundamental limitation in establishing the efficacy of this protocol is the small sample size of the groups, the prospective nature of the study with no randomization, the retrospective nature of the traditional recovery after surgery comparison group that did not permit for analysis of quality of recovery in this subset of patients.

**Recommendations**

On the basis of above study and observations, it can be recommended that

- ERAS programme is safe and effective, potentially reducing duration of stay in hospital, total ICU stay, post operative opioid usage.
- ERAS protocols suggest that implementation of this protocol will also im- prove efficiency of care, with improvements in overall resource use and cost of care.
- ERAS protocols have shown there is no increased risk of morbidities in com- parison with traditional care pathways
- Costs involved in setting up an ERAS programme and maintaining such an ERAS programme was much less compared to costs saved in reduced postoperative resource utilization.

**Ethics approval and consent to participate**

Institutional ethics committee approval and consent from all the patients has been obtained.

**List of Abbreviations**

ALT Anterio lateral thigh
CAD Coronary artery disease
DM Diabetes mellitus
ERAS Enhanced recovery after surgery
ERP Enhanced recovery programs
HTN Hypertension
HRS Hours
ICU Intensive care unit
IVF Intravenous fluid
LOS Length of stay
ML Millilitre
NGT Naso gastric tube
POD Post operative day
RAFF Radial artery forearm flap
RT Ryle's tube
SD Standard deviation
SRAS Standard recovery after surgery
STS Soft tissue sarcoma
TRAS Traditional recovery after surgery
WLE Wide local excision

**Conflicts of Interest**

There are no conflicts of interest.

**Funding Statement**

Nil

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