

Impact of an Enhanced Recovery After Surgery Protocol on Perioperative Outcomes for Head and Neck Cancer Patients Undergoing Free Flap Reconstruction

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Introduction

Enhanced Recovery After Surgery (ERAS) protocols, first described in colorectal surgery, aim to reduce perioperative stress, expedite recovery from major surgery, and promote return to normal function.

Among other critical perioperative goals, ERAS protocols aim to limit excessive fluid administration, which is associated with increased morbidity and surgical complications.

Major head and neck surgery with free flap reconstruction is resource-intensive and requires collaborative care from a multidisciplinary team. In 2017, Dort et. al published an ERAS protocol for major head and neck surgery and implemented it as part of an existing care pathway at the Foothills Medical Center in Calgary, Alberta, Canada.

We performed a practice and outcomes audit to explore the effect of an ERAS protocol on two important intraoperative outcomes:

1. Perioperative intravenous (IV) fluid administration
2. Intraoperative hypothermia

Methods and Analysis

Retrospective cohort study of 133 patients (>18 years) who underwent microvascular free tissue transfer surgery for head and neck oncological reconstruction from September 2016 - March 2019 at the University of Calgary. Patients with recurrent disease were excluded from the study.

Two patient groups were identified based upon timing of ERAS implementation (December 2017):

1. Pre-ERAS group: existing perioperative care pathway
2. ERAS group: ERAS-enhanced care pathway.

A post-hoc power calculation was performed with the known mean total IV fluid administered intra-operatively for pre- and post-ERAS cohorts. Using an alpha of 0.05, this yielded an estimated power of 0.77.

Intergroup comparisons were made using either Chi squared or Fisher’s exact tests for categorical variables. Continuous variables were compared using Student’s t-test or the Mann-Whitney U test. Intergroup comparisons were conducted using one-way ANOVA. In all cases a *p*-value < 0.05 indicated a statistically significant result.

Results

No differences were observed in patient demographics, clinicopathologic disease characteristics, cancer staging, or free-flap properties. Tracheotomy was more common in the pre-ERAS cohort (*p*=0.005).

ERAS patients were administered less fluid intraoperatively than pre-ERAS patients (*p*<0.001). Net fluid balances, rate of red blood cell transfusion (*p*<0.001), and 95% confidence intervals for total fluids administered were also decreased.

Duration of hypothermia was decreased in the ERAS group by a mean of 38 minutes.

Results Continued

Table 1: Clinical Characteristics

Characteristic	Number of Subjects (%)		p-value
	pre-ERAS n=49	post-ERAS n=84	
Sex			ns
	Male	39 (80%)	
	Female	10 (20%)	
Age (years)			ns
	Mean (SD)	61.4 (10.56)	
	Range	36 - 86	
ASA Group			ns
	1/2	31 (63%)	
	3/4	18 (37%)	
BMI			ns
	Underweight	2 (4%)	
	Normal Weight	16 (33%)	
	Overweight	16 (33%)	
	Obese	11 (22%)	
	Not Reported	4 (8%)	
Alcohol Consumption			ns
	Never Drinker	14 (29%)	
	Current Drinker	24 (49%)	
	Previous Drinker	5 (10%)	
	Not Reported	6 (12%)	
Smoking Status			ns
	Never Smoked	13 (27%)	
	Current Smoker	14 (29%)	
	Ex-Smoker	17 (35%)	
	Not Reported	5 (10%)	
Primary Site			ns
	Oral Cavity / Oropharynx	37 (76%)	
	Other Site	12 (24%)	
pT Classification			ns
	T1/T2	22 (45%)	
	T3/T4	24 (49%)	
	Not Reported	3 (6%)	
pN Classification			ns
	N0	26 (53%)	
	N+	23 (47%)	
Clinical Stage			ns
	I/II	13 (27%)	
	III/IV	35 (71%)	
	Not Stated	1 (2%)	
Tracheotomy			0.005 *
	Yes	43 (88%)	
	No	6 (12%)	
* Chi-squared test			

Table 2: Intraoperative Measures

Characteristic	Number of Subjects (%)		p-value
	pre-ERAS (n=49)	post-ERAS (n=84)	
Fluid Administration			
	Total Fluid Volume (ml), mean (SD)	4496 (1834.2)	3530 (1303.8)
	Total Crystalloid Volume (ml), mean (SD)	4275 (1644.5)	3431 (1276.3)
	Total Colloidal Volume (ml), mean (SD)	221 (508.4)	99 (271.2)
	Net Fluid Volume (ml), mean (SD)	3068 (1429.3)	2266 (1114.4)
Transfusion Incidence (n,%)			
	Estimated Blood Loss (ml), mean (SD)	603 (429.6)	537 (369.9)
			ns
			p=0.010 ^
Crude Hypothermic Time (minutes)			0.05 **
	Mean (SD)	118.0 (113.14)	80.4 (91.80)
	Range	0 - 588	0 - 494
Hypothermic Time as a Proportion of Total OR (%)			ns
	Mean (SD)	21.3 (19.50)	15.7 (16.77)
	Range	0 - 73.1	0 - 97.2
* Student's t-test ** Wilcoxon rank-sum test ^ Fisher's exact test			

Results Continued

Table 3: Postoperative Measures

Characteristic	Number of Subjects (%)		p-value
	pre-ERAS (n=49)	post-ERAS (n=84)	
ICU Admission			0.009 *
	Yes	44 (90%)	
	No	5 (10%)	
ICU Length of Stay (hours)			ns
	Mean (SD)	30.4 (29.22)	
	Range	2.9 - 139.7	
Postop Ventilator Usage			ns
	Yes	28 (64%)	
	No	16 (36%)	
Time on Ventilator (hours)			ns
	Mean (SD)	9.1 (16.7)	
	Range	0 - 82.4	
1st 24 Hours Postop Fluid Administration			ns
	Total Fluid Volume (ml), mean (SD)	3306 (1857.9)	
	Net Fluid Volume (ml), mean (SD)	1320 (1689.9)	
Acute Length of Stay (days)			0.04 **
	Mean (SD)	14.8 (9.25)	
	Range	5 - 50	
Total Length of Stay (days)			0.003 **
	Mean (SD)	15.7 (14.19)	
	Range	5 - 101	
Time to decannulation (days)			ns
	Mean (SD)	10.9 (9.52)	
	Range	3 - 49	
Clavien-Dindo Classification			ns
	No Complication	22 (45%)	
	Grade I - II	11 (22%)	
	Grade III - V	12 (24%)	
	Missing	4 (8%)	
* Chi-squared test ** Wilcoxon rank-sum test			

There was a significantly increased proportion of pre-ERAS versus ERAS patients requiring postoperative ICU admission (*p*=0.009)). Altogether, ERAS patients recorded a shorter mean length of hospital stay (*p*=0.002).

Conclusions and Discussion

Implementation of an ERAS protocol for head and neck cancer surgery with free flap reconstruction was associated with improvements in intraoperative fluid management, blood management, and hypothermia.

There were no adverse events or increase in rates of medical or surgical complications observed upon introduction of an ERAS protocol.

Additional research is required to better understand the impact of the ERAS protocol on other potentially important outcome measures, including postoperative nausea and vomiting, and perioperative pain management. Experiences from multiple centres is required to obtain adequate power to detect differences in perioperative morbidity secondary to ERAS implementation.

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