

**Risk factors and Incidence of wound dehiscence after neck dissection in patients with head and neck cancer**

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**ABSTRACT**

**Background:** Wound dehiscence is a complication after neck dissection (ND) in patients with head and neck cancer (HNC). We investigated the incidence, risk factors, and etiology of wound dehiscence among patients who underwent ND. **Methods:** A retrospective cohort study was performed on HNC patients, excluding those with thyroid cancer, who underwent surgery first in GSVM medical college, Kanpur. **Results:** The clinical charts of 60 patients were reviewed, 38 were male (63.33%) and 22 female (36.6%). The demographic and clinical characteristics are presented in Table I. out of 60 patient 12 take neoadjuvant CT and 2 neoadjuvant Rt. Out of 60 patients, 54 (90%) did not develop any complications, while 6 (10%) experienced some type of wound complication. The major complications that required surgical revision were wound dehiscence (6 cases, 10%).four patients who had previously received CRT and who developed wide cervical skin flap necrosis required secondary closure 8-10 day post surgery. No major vessel rupture was observed. **Conclusions:** Based on our results, we predict that certain groups of patients are at high risk for wound dehiscence after major HNC surgery. Preventive measures or close monitoring in these patients may be required to reduce the likelihood of postoperative wound dehiscence. Furthermore, even though additional research is required, we would consider changing the prophylactic antibiotic regimens according to the causative organisms.

**Key words:** Wound dehiscence, head and neck neoplasm's, microbiology

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**INTRODUCTION**

Head and neck cancer (HNC) is the sixth most common type of cancer, accounting for an estimated 650,000 new cancer cases and 350,000 cancer deaths worldwide every year.<sup>[1]</sup>More recently, the incidence of oropharyngeal cancer in the younger population has been increasing.<sup>[2]</sup>Surgery is the preferred treatment for HNC despite the fact that treatment of HNC is complex and involves multiple modalities. Wide resection and reconstruction as standard therapies for HNC have improved cure rates.<sup>[3]</sup> In patients with HNC, surgical site infection (SSI) has been the most frequent and significant complication, at varying rates.<sup>[4-7]</sup> The development of an wound dehiscence can cause prolonged hospital stays, increased health care costs, and delayed access to postoperative adjuvant therapy.<sup>[4,6,8]</sup>

However, significant discrepancies exist between the findings of these studies, and independent risk factors remain unclear. The current study was conducted to evaluate independent risk factors associated with wound dehiscence involving the oro-pharyngeal mucosa in HNC. In addition, we attempted to identify the causative organisms for these infections

**METHOD****Study design and patients**

We performed a retrospective cohort study to evaluate risk factors for wound dehiscence. Patients diagnosed with HNC underwent neck dissection [Figure 1]. In addition, only patients who were undergoing their first operations were included. Patients undergoing thyroid gland surgery with or without lymph node dissection and redo surgery were excluded. All operations were performed by same surgeons with more than 5 years of experience in head and neck major oncological surgery or reconstruction. All patients included in the study received prophylactic antibiotics, and all surgical sites were disinfected with providone iodine before incision. All patients received routine postoperative care, and

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surgeons or infectious disease specialists diagnosed SSIs.

**Definitions**

According to the Centers for Disease Control and Prevention’s NNIS and the criteria laid out by Horan et al. and Johnson et al., a wound dehiscence [Figure 2] was defined by the occurrence within 30 days of surgery: purulent drainage from the incision, spontaneous dehiscence or deliberate opening of the incisions with signs or symptoms of infection (pain, tenderness, localized swelling, redness, or heat), an isolated organism from the incision, purulent discharge from drainage, or an abscess without evidence of

clinical anastomotic leakage. According to the guidelines, wound dehiscence are classified as being either incisional or organ/space.

Incisional wound dehiscence are further divided into

- Those involving only skin and subcutaneous tissue (superficial incisional) and
- Those involving deeper soft tissue of the incision (deep incisional).
- Organ/space SSIs involve any part of the anatomy other than incised body wall layers that were opened or manipulated during an operation.



Figure 1: After surgery



Figure 2: within 30 days of surgery: purulent drainage from the incision

**Statistical analysis**

The chi-square or Fisher exact tests were used to compare categorical variables.

**RESULTS**

**Clinical characteristics**

During the study period, a total of 60 patients with HNC were included in this study.

**Table 1: Demographic details (n=60)**

Characteristics	Total patients	Patients with wound dehiscence	Patient without wound dehiscence	Percentage %
Mean Age <45 year	12	1	11	8.3%
>45 year	48	5	43	10.41%
Sex male	Male -38	4	34	10.52%
Female	Female -22	2	20	9%
Smoking yes	53	6	47	11.32%
No	7	0	7	0%
Alcohol yes	33	5	28	15.15%
No	27	1	26	3.7%
Tobacco chewer yes	56	6	50	10.71%
No	4	0	4	0
Underlying decease	13	3	10	23.07%
• DM	3	0	3	0
• Cardiac de	1	0	1	0
• Respi	0	0	0	0
• Renal	0	0	0	0
• Neurological	2	2	0	100%
• Liver decease				
Primary site of tumor				
• Oral cavity	57	5	52	8.7%
• Salivary gland	1	0	1	0
• Neck	2	1	1	50%
Pre op hospital stay < 3day	47	4	43	8.5%

>3day	13	2	11	15.38%
Neo-adj CT	12	4	9	33.33%
Neo-adj RT	2	0	2	0%
SOND	43	4	39	9.3%
RND	0	0	0	0
MRND	17	2	15	11.76%
<b>Incision</b>				
scalpale-	34	3	31	8.8%
Electrocautery-	26	3	23	11.53%
<b>Skin closure</b>				
Sutre-	29	2	27	6.8%
Stapler-	31	4	27	10.81%

The clinical charts of 60 patients were reviewed, 38 were male (63.33%) and 22 female (36.6%). The demographic and clinical characteristics are presented in [Table 1]. out of 60 patient 12 take neoadjuvent CT and 2 neoadjuvent Rt. Out of 60 patients, 54 (90%) did not develop any complications, while 6 (10%) experienced some type of wound complication. The major complications that required surgical revision were wound dehiscence (6 cases, 10%). Four patients who had previously received CRT and who developed wide cervical skin flap necrosis required secondary closure 8-10 day post surgery. No major vessel rupture was observed. All infected wounds responded to conservative treatment with parenteral antibiotics. Similarly, wound dehiscence was taken care of and was resutured later. Out of 60 patient skin incision done by scalpale in 34 patient and by electrocautery 26 patient,

using scalpale 31out of 34 patients (91.17 %) were having no complications. Three patients (8.8%) had wound dehiscence. Skin incision using electrocautery, 23 out of 26 patients (88.46 %) were having no complications. Three patients (11.53 %) had wound dehiscence. [Table 1]. Out of 60 patient skin closure done by suture in 29 patient and by stapler 31 patient, using suture 27out of 29 patients (93.10 %) were having no complications. two patients (6.8 %) had wound dehiscence, skin closure using stapler, 27 out of 31 patients (87.09 %) were having no complications. four patients (12.90 %) had wound dehiscence. [Table 1]

#### Risk factors for SSIs

The association of wound dehiscence with preoperative variables is summarized in [Table 1].

**Table 2: Summarizes the association of wound dehiscence with perioperative variables. In the univariate analysis (n=60)**

Characteristics	Total patients	Patients with wound dehiscence	Patient without wound dehiscence	Percentage
Prophylactic antibiotics <1 hour	Yes-48	2	46	4.16%
	No – 12	4	8	33.33%
Prophylactic antibiotics	Yes- inj ceftriaxone	6	0	10%
Incision route	External	6	0	10%
Blood transfusion yes -3 No -57		0	3	0
		6	51	11.76%
Blood loss <300 ml >300 ml	Yes- 53	3	50	5.6%
	No- 7	3	4	42.8%
Operative time	<100 min-28	2	26	7.14%
	>100 min-32	4	28	12.50%

Multivariate analysis revealed that being male, having a long operation time (over 6 hours), underlying cardiovascular disease, and blood loss during the operation of more than 300 ml were independent risk factors for SSIs. The rate of wound dehiscence group

of patients submitted to concurrent CRT was 33.33% and 0%, respectively, In those submitted to SONND or MRND, the proportions were 9.3% and 11.76%, respectively, versus 5.4% and 12.5% in those who underwent selective neck dissection (SND) (p = 0.05).

The variables associated with complications were analyzed by multivariate analysis in order to assess the OR for wound complications.

#### Causative microorganisms

A microbiological analysis was performed in all patients with SSIs, and patients showed positive

culture results [Table 3]. 3 (50%) out of 6 shows positive for staphaureus, 1(17.66%) out of 6 show positive for *pseudomonas*, 1 *candida*, 1 *streptococcus pneumoniae*.

**Table 3: A microbiological analysis was performed in all patients with SSIs, and patients showed positive culture results**

Microorganism	No %
Gram-positive aerobes	
<i>Staphylococcus aureus</i>	3(50%)
<i>Streptococcus pneumonia</i>	1(16.66%)
Gram-negative aerobes	
<i>Pseudomonas aeruginosa</i>	1(16.66%)
<i>Candida</i>	1(16.66%)

#### DISCUSSION

Approximately 10% of patients in the present series experienced postoperative wound dehiscence. Multivariate analysis<sup>[2-8]</sup> showed that previous con-current CT for head and neck tumours and type of neck dissection were associated with a high risk of wound dehiscence. At present, only a few studies have reported the rate of local postoperative complications after neck dissection.<sup>[3-7]</sup>Published data on the association between RT or CRT and wound complications are discordant, with the reported incidence of wound complications after CRT varying from 3% to 61%.<sup>[2-9]</sup>Some authors have reported that they have not found any significant differences in terms of complications between groups of patients who were or were not submitted to preoperative RT or CRT. Others assumed that CRT should be considered a risk factor for wound complications. Davidson<sup>[8]</sup> observed the following wound complications: full-thickness necrosis, facial swelling, chyle fistula, seroma, marginal nerve injury, haematoma and suture abscess in 9 of 41 (22%) patients treated with planned neck dissection (PND). In the case series reported by Reza-Nouraei<sup>[9]</sup>, PND caused 8 out of 49 (20%) significant complications, resulting in swallowing and breathing deterioration, wound infection with bleeding, and shoulder morbidity requiring an Eden-Lange procedure. Maran *et al*<sup>[10]</sup>reported data on a series of 394 neck dissections mostly associated with surgical resection of the primary tumour. The authors noted a higher risk of wound breakdown in previously irradiated patients (25%) versus the untreated group (5%).The present study confirmed that CT is a risk factor for major wound complications. The higher complication rate usually observed in previously chemo- patients was

due to the tissue response to chemo. Currently, normal tissue reaction to chemotherapy is regarded as a dynamic and progressive process with individual differences due to genetic variations leading to problems with wound-healing. CRT activates a different wound-healing process from that of normal wound healing, causing an excessive deposition of extracellular matrix and collagen that is characteristic of radiation fibrosis. Furthermore, radiation also induces vascular damage, and the above-mentioned remodeled tissue can lead to tissue hypoxia, perpetuating a fibrogenic response. This tissue alteration determines a delayed and altered wound-healing process after surgery compared to that of normal tissue. Patients due to undergo a PND after RT or CRT should be informed about the increased risk of the procedure. The type of neck dissection was associated with major wound complications. The OR for major wound complications was 1.5-fold higher in the case of MRND or RND than in the case of SND, and this could be correlated to the wider surgical field resulting from the more extensive procedures. In addition, MRND and RND were performed via a tri-flapped incision, while a bi-flapped incision was adopted for SND. It can be assumed that the use of 3 flaps results in reduced vascularization at the periphery of the skin followed by ischemia, which may explain the higher incidence of skin-flap necrosis or dehiscence. In any case, all the RND/MRND procedures in the present study were associated with a 3-flap incision, and further studies are needed to assess if these complications can be avoided by the use of a 2-flap incision for the same type of neck dissection. The nomenclature adopted in this study for ND is accepted worldwide, even if it may deserve revision as reported by many authors. However, the present result differs

from others published in the literature. Davidson et al. noted that the type of ND did not alter the rate of complications.<sup>[8]</sup> Similarly, wound or systemic complications did not correlate with preoperative hemoglobin level, haematocrit, white blood cell or platelet count.<sup>[8]</sup> Our study could not confirm any association between preoperative blood values and the occurrence of complications. Surgical diathermy was introduced at the beginning of the 20<sup>th</sup> century<sup>[11-14]</sup> to obviate the inherent disadvantages of steel scalpel, i.e. (1) lack of hemostasis leading to undesired blood loss; (2) indistinct tissue planes; (3) increased operative time; (4) use of foreign material (ligature) in the wound, leading to infection risk; (5) possibility of accidental injury in the operations theater; and (6) potential for tumor metastasis through lymphatic channels.<sup>[15-17]</sup> With the advent of modern electrosurgical units capable of delivering pure sinusoidal current, this technique is now becoming extremely popular because of rapid hemostasis, faster dissection and reduced overall operative blood loss.<sup>[17-21]</sup> However, electrosurgery may cause complications, with electrical burns being the most common hazard in operating room.<sup>[22]</sup> Inadvertent burns may occur at the surgical site or at the site of placement of the dispersive electrode (grounding pad).<sup>[23-25]</sup> Electrosurgery related fire hazards have also been reported in the literature before the advent of non-explosive anesthetic agents. Following the introduction of halothane, electrosurgery has been widely used as has been described in thyroidectomy by head and neck surgeons<sup>[26]</sup> and blepharoplasty by plastic surgeons.<sup>[27]</sup> Excellent cosmetic results with minimal scarring have also been reported in reconstructive and cosmetic faciomaxillary surgery.<sup>[28]</sup> Electrosurgical incision is not a true cutting incise.<sup>[29]</sup> It acts by heating the cells within the tissue so rapidly that they explode into steams, leaving a cavity. When the electrode is moved forward, fresh tissue is contacted, new cells are exploded and an incision is made. This phenomenon may explain minimal blood loss and healing with minimal amounts of scar tissue. On the basis of this study, it is suggested that the skin may be safely incised using electrosurgery. Complications like contracted wounds, hypertrophic scar formations and increased infections rates were not found and the technique has been shown to be particularly useful in making head and neck incisions. It may be the ideal method of skin incision in these patients as the conservation of blood and operating time is very important in onco-surgery. These data demonstrate a significant advantage for the exclusive use of surgical diathermy in head and neck incision in cancer patients. Furthermore, the recent increase in blood borne diseases such as hepatitis C and human

immunodeficiency virus infections makes exclusion of the scalpel from the operative field an attractive option and the role of scalpel in making incision may be completely taken over by the electrocautery.<sup>[30]</sup> A Pubmed survey of 2009 shows few publications which have also included incision time and postoperative pain during diathermy incision.<sup>[31]</sup> In our study, no differentiation was made for the individual step including the operating time. It is the total time of operation that is important. Researchers have also investigated the hypothesis that application of extreme heat may result in significant postoperative pain and poor wound strength because of excessive tissue damage and scarring, respectively, and have observed that there was no difference between the two groups in terms of wound strength. Infectious complications were totally absent. Surgical diathermy is a safe and effective method to make skin incision. The electrocautery skin incision helps in the conservation of blood at the beginning of operative procedure and fear of increased infection rates is unfounded.

Complications were reported in both the groups. These patients were managed by antibiotics and secondary suturing whenever required. Although there is no statistically significant difference between both the groups ( $P = 0.77$ ) but there were more wound dehiscence in stapler group. Advantages of staples include rapid placement, excellent cosmetic results, less tissue strangulation than sutures, minimal tissue reactivity, and low incidence of wound infections. Reported disadvantages of staples include interference with computed tomography scans, less meticulous approximation of wound edges in anatomically complex regions and the cost.

The ultimate responsibility for the choice of the best material lies with the surgeon. Choosing a method of closure that affords a technically easy and efficient procedure, with a secure closure and minimal pain and scarring, is paramount to any surgeon. From the results of this study, we suggest that skin staples are better alternative to conventional sutures in head and neck cancer surgery as they offer:

- Ten times faster wound closure than sutures.
- Cost effectiveness if total cost of closure is considered although cost of material was almost double than suture closure.

Similar results to sutures in terms of patient comfort, aesthetics outcome and complication. All complications were successfully treated after medication and/or surgical revision. Wound dehiscence was the most frequent major complication and require secondary closure. Minor wound complications associated with neck dissection were not evaluated with a two-sided chi-square test, two-sided Fisher's

exact test or multivariate analysis due to the low number of cases. Nonetheless, some conclusions can be drawn from the descriptive statistics: minor complications were present in patients with all the analyzed variables, and in particular, 2 cases (3.3%) without concurrent CRT showed wound dehiscence compared to 0 cases in the group with concurrent RT. Approximately half of patient of wound dehiscence shows secondary infection of staph aureus on pus culture.

### CONCLUSION

Based on our results, we predict that certain groups of patients are at high risk for wound dehiscence after major HNC surgery. Preventive measures or close monitoring in these patients may be required to reduce the likelihood of postoperative wound dehiscence. Furthermore, even though additional research is required, we would consider changing the prophylactic antibiotic regimens according to the causative organisms

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