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Internal jugular vein rupture after oncologic resections in the head and neck



Ahmad M. Elteley, Ahmed A. Nassar^{*} , Ahmed M. El Batawi and Sherif G. Ibrahim

Abstract

Background: Internal jugular vein (IJV) blowout after major oncologic resections in the head and neck is a rare fatal yet preventable complication. The condition is unregistered sufficiently in the literature.

Results: The records of patients who underwent oncologic neck surgery were retrospectively reviewed. The study included records between January 2014 and November 2019 at Kasr Al Ainy Educational Hospital. 275 patients underwent cervical ablative procedures. Ten patients developed IJV blowout. Six patients were saved. Four patients had diabetes mellitus with postoperative wound infection and dehiscence. Three patients were given primary radiotherapy; two of them developed flap necrosis. Eight patients acquired pharyngocutaneous fistula (PCF). Regional flap coverage was done in three patients. Sentinel hemorrhage occurred in all patients.

Conclusions: IJV blowout is a rare potentially life-threatening complication usually preceded by sentinel hemorrhage. The condition is essentially preventable by the prompt and structured response.

Keywords: Rupture, Internal jugular vein, Neck dissection, Sentinel, Bleeding

Background

Major vascular blowouts after oncologic resections in the head and neck are rare postoperative complications [1]. The incidence of internal jugular vein (IJV) rupture is escalating with the increased performance of functional and modified radical neck dissections which entail preservation of the IJV [2]. Deep neck space infections following these surgical modalities largely predispose to this life-threatening yet preventable complication [3]. Being an infrequent complication, there was paucity of the reports discussing IJV blowout after head and neck surgery in the medical literature. According to the best of our knowledge, the maximum number obtained by reviewing the medical literature was six patients in a single report [4].

In this article, we are describing our institutional experience with IJV blowout after major oncologic resections in the head and neck. By practicing at a tertiary care center,

we were able to retrospectively review the data of 275 patients who had head and neck malignancies treated surgically from January 2014 to November 2019. During this period, we had 10 cases of IJV blowout; representing the highest number of cases describing the condition in the medical literature up till now.

Methods

The medical records of patients who underwent oncologic resections in the neck—at a tertiary care center—were retrospectively reviewed. The study was conducted between January 2014 and November 2019. The incidence of IJV blowout was determined. Associated possible risks and perioperative events were also examined. These included age, associated medical co-morbidities, primary radiotherapy, surgical procedure in detail, postoperative wound infection, postoperative wound dehiscence, regional flap coverage, sentinel bleeding, time of rupture, and the survival.

Results The total number of patients who had oncologic neck resections was 275. Ten patients had IJV blowout. All patients were men. The median and mean ages were

* Correspondence: Ahmedaminassar1@kasralainy.edu.eg
Otolaryngology Department, Faculty of Medicine, Cairo University, 4
Mohamed Yousef Othman ST, Al zohour district, Omraneya, Giza, Cairo
12552, Arab Republic of Egypt

60.5 years (range: 56 and 67). The median interval between the ablative procedure and the IJV blowout was 15 days (range: 12 and 30) while the mean was 18 days. The associated possible risks for IJV blowout and the perioperative events are shown in Table 1. All patients developed at least an attack of sentinel bleeding, but not all patients underwent urgent neck exploration after this attack. The first patient (Fig. 1) had T4a laryngeal carcinoma (LC) extending to the upper 3 tracheal rings. They were resected en-block with the laryngectomy together with another 2 rings as a safety margin. The second patient had T2 LC but he had restrictive lung disease and partial laryngectomy was not feasible. He refused primary radiotherapy as a treatment modality and preferred surgery. He developed wound infection followed by postoperative pharyngocutaneous fistula (PCF) on a postoperative day 10 (D10). He had IJV blowout on D13 which was managed by urgent neck exploration, ligation of the IJV, and wound debridement. After that, he had repeated wound dressings and antibiotics with a successful cure of infection. The residual wound dehiscence was well managed by pectoralis major myocutaneous flap (PMMCF) coverage. The third patient (Fig. 2) had recurrent papillary thyroid carcinoma (rPTC) for which he had two operations—with no available details—followed by external beam radiotherapy and radioactive iodine (RAI) ablation outside our institution. After the failure of all the previously mentioned measures, he was referred to our hospital and he had total laryngectomy (TL), total thyroidectomy (TT), bilateral modified radical neck dissection (BMRND) with preservation of the IJV on both sides, and PMMCF augmentation of the wound. The fourth patient had recurrent laryngeal carcinoma (rLC) after primary chemoradiation (CRTH), and he had solitary single pulmonary metastasis (PM). The medical oncologist strongly recommended salvage surgery to be followed by postoperative chemotherapy to decrease the morbidity resulting from the metastatic nodule. The patient had TL, TT, and bilateral selective neck dissection (BSND). He developed a rupture of the IJV with successful ligation. That was followed by ICU admission at which he developed CCA rupture 24 h after the previous event. The 5th patient had T4a LC which was managed surgically. Despite the fact that he had PCF, he developed neither wound infection nor dehiscence. When he developed brisk IJV bleeding, he was urgently transferred to the theater and the vein was ligated. He was then dispatched to the ICU but he died early after. Patients 6, 7, and 8 had PCF after urgent neck exploration to control the bleeding (iatrogenic pharyngeal wall injury). The sixth patient had LC which was surgically treated 3 years ago. Twelve days after the initial surgery, he developed brisk bleeding from the stoma. Urgent wound exploration revealed IJV rupture

and it was successfully ligated. The patient survived but later developed tumor recurrence. After 3 years, he had massive bleeding urging immediate exploration which revealed invasion of the common carotid artery (CCA) by the tumor recurrence. It was successfully ligated but the patient died early after. Indeed, understanding the risk factor—that might have been the cause for the IJV rupture in this patient—is very challenging. This patient did not have any associated medical comorbidities. He had neither postoperative wound infection nor dehiscence. Also, he was not given primary radiotherapy; however, he developed IJV blowout on D12. Probably, the absence of any risk factor was one of the leading causes that this patient was a survivor after the initial bleeding attack. The 7th patient had rLC after primary radiotherapy. He had supraclavicular (SCF) flap augmentation of the pharyngeal closure together with the ablative procedure. He started to have sentinel bleeding on postoperative day 11. He had another event on day 13. On day 16, he developed brisk bleeding from the stoma warranting urgent exploration during which the pharynx was injured resulting in postoperative PCF. The IJV was found to be the source of bleeding, and it was successfully ligated and controlled. He was then referred to the ICU and later to the ward with repeated wound dressing and fistula care. Finally, the fistula was closed and he was discharged home to become the last survivor in the study. The 8th patient had postoperative subclavian vein thrombosis which was managed by low molecular weight heparin (LMWH) therapeutic dose injection. After the first attack of sentinel bleeding, the patient underwent urgent neck exploration during which the pharynx was injured and repaired but resulted in PCF. Surprisingly, neck exploration was negative for a definite bleeder but revealed diffuse ooze from the operative bed probably due to (LMWH) toxicity. On the next day, the drain had 600 cc of fresh blood warranting another neck exploration which was negative for a definite bleeder as well. A few days later, he had severe bleeding from IJV blowout which was successfully ligated but the patient passed away shortly after the operation. The 9th patient (Fig. 3) had T3 LC for which total laryngectomy and bilateral lateral neck dissection was done. He developed wound infection followed by postoperative pharyngocutaneous fistula (PCF) on a postoperative day 10 (D10). He had IJV blowout on day 12 which was managed by urgent neck exploration, ligation of the IJV, and wound dehiscence. After that, he had repeated wound dressing and antibiotics with a successful cure of infection. The 10th patient (Fig. 4) had T4 LC for which total laryngectomy and bilateral lateral neck dissection was done. He developed wound infection followed by postoperative pharyngocutaneous fistula (PCF) on a postoperative day 9 (D 9). He had IJV blowout on day 12 which was managed by

Table 1 Associated risks and perioperative events

	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10
Age	56	63	57	62	67	57	59	63	57	62
Primary	LC T4aN0M0 (subglottic)	LC T2N0M0	rPTC T4aN1bM0	rLC T4aN1M1	LC T4aN0M0	LC T4aN0M0	rLC T3N0M0	LC T4aN0M0	LC T3N0M0	LC T4aN0M0
Medical co-morbidity	DM IHD COPD	DM CRLD	FREE	PM	FREE	FREE	FREE	DM	DM	Free
Primary radiotherapy	NO	NO	YES + RAI	CRTH	NO	NO	YES	NO	NO	No
Surgical procedure	TL TT CND Upper 5 tracheal rings resection	TL TT BSND	TL TT BMRND	TL TT BSND	TL RrHT BSND	TL BSND	TL BSND	TL BSND	TL BSND	TL RrHT BSND
Postoperative wound infection	Yes	Yes	No	No	No	No	No	Yes	Yes	Yes
Postoperative wound dehiscence (flap necrosis)	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes
Postoperative PCF	No	Yes D10	No	Yes D9	Yes D9	Yes After IJV ligation	Yes After jiv ligation	Yes D20 After the 1st neck exploration	Yes D10	Yes D 9
Flap coverage	No	PMMCF 2 weeks after rupture	PMMCF	No	No	No	Scf	No	No	No
Sentinel bleeding	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time of rupture	D16	D13	D14	D30	D13	D12	D16	D30	D12	D12
Survival	Death Cardiogenic shock	Survived	Death	Survived then carotid blowout 1 day after IJV ligation	Death	Survived then CCA blowout after 3 years then death	Survived	Death	Survived	Survived

Abbreviations: LC laryngeal carcinoma, rPTC recurrent papillary thyroid carcinoma, rLC recurrent laryngeal carcinoma, DM diabetes mellitus, IHD ischemic heart disease, COPD chronic obstructive pulmonary disease, CRLD chronic restrictive lung disease, PM pulmonary metastasis, RAI radioactive iodine, CRTH chemoradiotherapy, TL total laryngectomy, TT total thyroidectomy, CND central neck dissection, BSND bilateral selective neck dissection, BMRND bilateral modified radical neck dissection, RrHT right hemithyroidectomy, IJV internal jugular vein, PMMCF pectoralis major myocutaneous flap, SCF supraclavicular flap, CCA common carotid artery

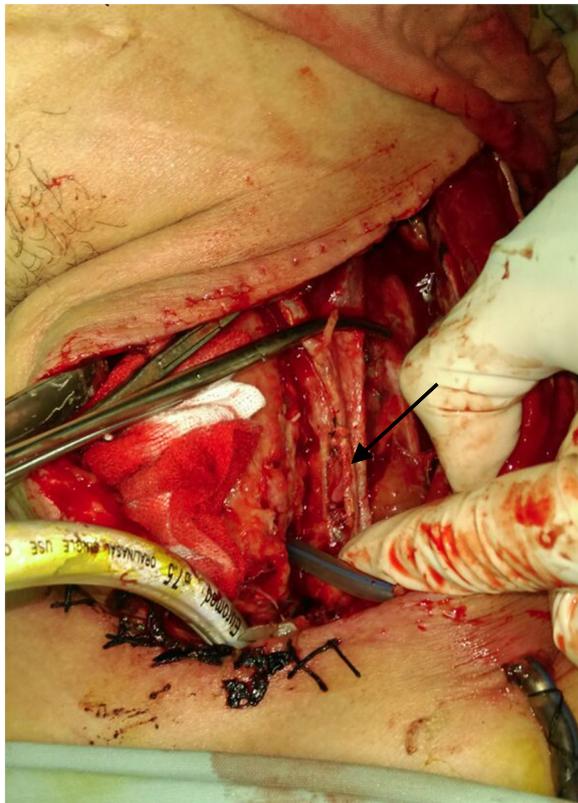


Fig. 1 Left-sided intraoperative ruptured internal jugular vein (black arrow) in the first patient

urgent neck exploration, ligation of the IJV, and wound dehiscence. After that, he had repeated wound dressing with a successful cure of infection.

Discussion

Our study showed that ten patients developed IJV blow-out after having neck surgery for oncologic resection with some sort of neck dissection. Although selective surgical techniques for addressing the cervical lymph nodes during the procedure of neck dissection has led to more preservation of vital structures, those preserved structures have become liable to postoperative morbidity and complications. Primary radiotherapy and salivary fistulae remained as major contributing factors to catastrophic vascular insults. Breaching the outer adventitial layer of the vessel has always been a culprit in the pathogenesis of vessel rupture [5]. In the present study, five patients had PCF before the IJV blowout while another three acquired it while managing the bleeding. Three patients were given primary radiotherapy. One did not develop PCF, the other developed it before IJV rupture and the last one acquired the fistula as a traumatic complication during urgent neck exploration to control IJV bleeding. Owing to the paucity of this condition, statistical significance could not be determined for specific



Fig. 2 Left-sided wound infection and dehiscence in the third patient

factors; however, it seems that there is a strong association between primary radiotherapy, the development of PCF, and the blowout of the IJV if the operative procedure entailed the preservation of the IJV with extensive dissection around its lower part.

Radiotherapy has double effects (early and late) on the process of wound healing. Connective tissue cells have an intermediate response to the radiation. The irradiated tissues always exhibit hypoxia owing to small blood vessel obliteration, and there is also a reduction in the production of collagen by fibroblasts. The net result of the previously mentioned effects is inverse affection of both the proliferative and maturation phases of wound healing [6]. In our study, we had two patients who had PMMCF coverage of the wound and one patient with SCF coverage. A patient had PMMCF in the same session with the ablative procedure because he was previously given radiotherapy as an adjunctive therapy to recurrent papillary thyroid carcinoma. Unfortunately, this patient died of IJV blowout despite the fact that his neck vessels were covered with the flap. Another patient had PMMCF coverage of the wound in a separate procedure after the event of IJV ligation. Fortunately, this patient survived. One other survivor was given primary radiotherapy and had SCF in the same session with the



Fig. 3 Left-sided internal jugular vein rupture (black circle) and pharyngocutaneous fistula (white circle) in the 9th patient

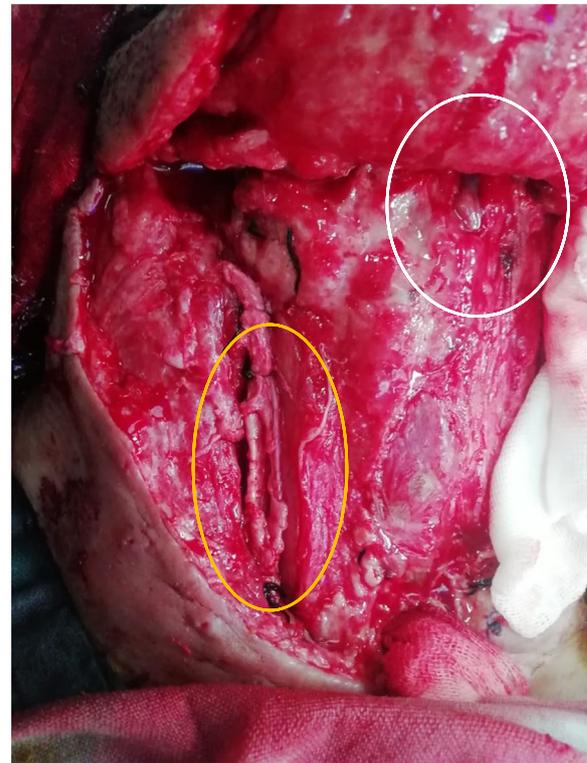


Fig. 4 Right-sided internal jugular vein rupture (yellow circle) and pharyngeal fistula (white circle) in the 10th patient

laryngectomy and neck dissection operation. So, out of four survivors, two patients had regional flap coverage.

Sentinel bleeding is described as an accidental and short gush of the blood from the wound. A history of such an event warrants comprehensive and urgent evaluation. If no further bleeding is observed, the patient is admitted for follow-up and imaging of the neck vessels is mandatory. Computerized tomography (CT) is usually preferred. Air bubbles on imaging found in the vicinity of a major vascular structure is a risk sign of impending rupture. The required intervention is always adjusted according to the patient condition, and it may vary from instituting aggressive intravenous antibiotic therapy to elective reconstructive procedures [7]. In the present study, sentinel bleeding occurred in all the patients. Indeed, not all patients had neck exploration after the first attack which eventually leads to brisk bleeding later with the need for urgent IJV ligation.

Sulaiman and charters reported the shortest interval between neck surgery and IJV rupture which was 9 days [8]. The longest duration before IJV blowout was 23 days as given by Hudorović and Vucetic [9]. In their review, Genden and colleagues reported that the incidence of IJV hemorrhage occurred 14 days after the operation [3, 10]. In the present study, our research team found that the

median period between the operation and the incidence of IJV burst was 15 days ranging between 12 and 30 days postoperatively. We had 5 events in the 2nd postoperative week, two in the 3rd week, and the two on postoperative day 30.

In summary, the research team for the present study concludes that IJV blowout is a catastrophic postoperative complication which ended up with mortality in half of the patients. The use of primary radiotherapy and organ preservation protocols for managing locally advanced head and neck carcinoma has led to an increase in the number of cases. The dangerous gap for the blowout seems to be present between the second and the fourth weeks postoperatively. Prompt response with urgent ligation of the vein may save the patient life. Sentinel bleeding usually precedes all cases of IJV rupture. The condition could be prevented with the proper identification of the sentinel bleeding which warrants—as a minimum—hospital admission, close observation, aggressive parenteral antibiotics, thorough wound care, and anatomical imaging of the neck vasculature. Clinical suspicion may justify emergency neck exploration and dealing accordingly. Such an approach may lead to prevention or early recognition of the condition which will decrease both patient morbidity and mortality.

Conclusions

IJV blowout is a rare potentially life-threatening complication usually preceded by sentinel hemorrhage. The condition is essentially preventable by the prompt and structured response.

Abbreviations

LC: Laryngeal carcinoma; rPTC: Recurrent papillary thyroid carcinoma; rLC: Recurrent laryngeal carcinoma; DM: Diabetes mellitus; IHD: Ischemic heart disease; COPD: Chronic obstructive pulmonary disease; CRLD: Chronic restrictive lung disease; PM: Pulmonary metastasis; RAI: Radioactive iodine; CRTH: Chemoradiotherapy; TL: Total laryngectomy; TT: Total thyroidectomy; CND: Central neck dissection; BSND: Bilateral selective neck dissection; BMRND: Bilateral modified radical neck dissection; RtHT: Right hemithyroidectomy; IJV: Internal jugular vein; PMMCF: Pectoralis major myocutaneous flap; SCF: Supraclavicular flap; CCA: Common carotid artery

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None.

Authors' contributions

AME; drafting the work. AAN; contribution to the conception of the work, acquisition, interpretation of data. AMB; revising the work. SGI; revising the work critically for important intellectual content. All authors read and approved the final manuscript.

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

All procedures performed in the study were in accordance with the ethical standards of the practice at which the study was conducted (Otolaryngology department, Faculty of Medicine – Cairo University ethical committee; permit number: 4-12-2016).

Consent to Participate

Not applicable as this is a retrospective study.

Consent for publication

Written informed consent for publication of the patients' clinical details and clinical images was obtained from the relatives of the patients.

Competing interests

None to declare.

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References

1. Wurster CF, Krespi YP, Sisson GA, Ossoff RH, Becker SP (1985) A new complication of modified neck dissection: internal jugular vein blowout. *Otolaryngol Neck Surg* 93(6):812–814. <https://doi.org/10.1177/019459988509300623>
2. Timon CI, Brown D, Gullane P (1994) Internal jugular vein blowout complicating head and neck surgery. *J Laryngol Otol* 108(May 1994): 423–425
3. Ota Y, Aoki T, Karakida K, Miyasaka M (2001) A case of rupture of the internal jugular vein caused by postoperative infection of functional neck dissection. *Tokai J Exp Clin Med* 26(4-6):123–125
4. Cleland-Zamudio SS, Wax MK, Smith JD, Cohen JI (2003) Ruptured internal jugular vein: a postoperative complication of modified/selected neck dissection. *Head Neck* 25(5):357–360. <https://doi.org/10.1002/hed.10219>
5. Kerwala CJ (2010) Complications of head and neck cancer surgery - prevention and management. *Oral Oncol* 46(6):433–435. <https://doi.org/10.1016/j.oraloncology.2010.03.013>

6. Gokhale AS, Lavertu P (2001) Surgical salvage after chemoradiation of head and neck cancer: complications and outcomes. *Curr Oncol Rep* 3(1):72–76
7. Quintanilla-dieck L, Gross ND. Injury of the Major Vessels. *Thyroid Su.* (Miccoli P, Terris DJ, Minuto MN, Seybt MW, eds.). New York: John Wiley & Sons, Ltd; 2012.
8. Sulaiman L, Charters P (2005) Survival after massive bleeding into the airway in a patient at risk from "can't intubate, can ventilate.". *Anaesthesia*. 60(12): 1231–1234. <https://doi.org/10.1111/j.1365-2044.2005.04337.x>
9. Hudorović N, Vucetic B (2008) Infrequent life-threatening complication of descending necrotizing mediastinitis; vertebral artery, internal jugular and subclavian vein rupture. *Int J Surg* 6(6):48–51. <https://doi.org/10.1016/j.ijsu.2007.02.001>
10. Genden EM, Ferlito A, Shaha AR et al (2003) Complications of neck dissection. *Acta Otolaryngol.* 123(7):795–801. <https://doi.org/10.1080/000116480310001871>

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