

Blood Transfusion Requirements in Otolaryngology—Head and Neck Surgery

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Background: Blood requirements for Head and Neck surgical procedures have not been studied carefully. In order to set up an autotransfusion program, the blood loss and transfusion requirements should be known precisely. **Methods:** The blood bank database was used to determine which Head and Neck procedures required blood transfusion during the previous 5 years. A list of 10 transfusion-associated operations was established, the records of all patients who underwent these procedures during a 5-year period were reviewed, and average the blood loss and number of units transfused determined. **Results:** All procedures were for cancer resection. The operations were classified in 3 groups according to their transfusion probability: high (>80%), low (<5%) and moderate. For the moderate transfusion group, age, preoperative hemoglobin, and past medical history of cardiac and pulmonary disease were associated with higher incidence of transfusion. An average delay of 3 weeks was found between the diagnosis and the actual surgery. **Conclusion:** The transfusion requirements of Head and Neck surgical procedures could be safely met by an autotransfusion protocol, given the average delay of 3 weeks between diagnosis and surgery. **Key words:** blood loss, cancer, head and neck, surgery, transfusion.

INTRODUCTION

Head and Neck surgical operations are often associated with major blood loss requiring substitution, usually by homologous blood transfusion since other sparing techniques such as hemodilution and intraoperative blood recuperation are usually insufficient. Furthermore, intraoperative blood recuperation has not been reported for Head and Neck cancer operations, probably because it is oncologically unsafe (1). The risk related to homologous blood transfusions are well known (2, 3). In addition of the usual complications, some studies show an increase in the frequency of the cancer recurrences (4–9) and a higher incidence of postoperative infections (10, 11). While these topics are still controversial (12–16), there is growing interest in autotransfusion programs (2, 3). Autotransfusion requires better preoperative planning, an advance knowledge of the expected blood loss, and sufficient time gap between the diagnosis and the operation. The goal of this study is to retrospectively examine the intraoperative blood loss and transfusion requirements for the various types of Head and Neck surgical procedures.

MATERIALS AND METHODS

This is a retrospective study of patients operated in the Otolaryngology—Head and Neck Surgery Department of the University of Geneva between 1990 and 1995. The blood bank database was used to identify patients receiving blood transfusions. Patients who were transfused but not operated on were

excluded (most of these cases were secondary to epistaxis or chemotherapy related anemia).

Blood was requested for 14 types of surgical procedures. A total of 259 patients underwent one of these operations and their records were analyzed, independently of the transfusion status. Thirty two patients were excluded because their charts could not be located or because the information was incomplete.

A total of 227 charts were reviewed, analyzing the following parameters: the estimated intraoperative blood loss, the number of blood units transfused during or after surgery, the age of the patient, his/her cardiac and pulmonary medical history, the preoperative and postoperative hemoglobin and hematocrit, and the delay between diagnosis and actual surgery.

For each procedure, the parameters known before the operation were compared between transfused and non-transfused patients. Age and preoperative hemoglobin were analyzed using the Student *t*-test and incidence of past medical history was assessed with the χ^2 test and statistics.

RESULTS

All operations requiring a blood transfusion were oncologic procedures for resection of Head and Neck cancer. No otologic, nasal sinus or facial plastic procedure required a transfusion during the study period.

In the 227 patients, there were 41 women (18%) and 186 men (92%). The average age was 58.7 ± 9 years.

Table I. *Head and neck operations that required blood transfusion*

The operations are classified according to the localization of the primary

Operations	Number of cases	Percent of transfused	Number of blood units transfused	Blood loss: transfused patients [l]	Blood loss: non-transfused patients [l]
Neck dissections					
1. Bilateral radical neck dissection	4	100	3.2 ± 0.8	1.2 ± 0.2	—
2. Unilateral radical neck dissection	18	22	2.0 ± 0.0	0.9 ± 0.2	0.4 ± 0.2
3. Bilateral functional neck dissection	7	0	—	—	0.4 ± 0.2
4. Unilateral functional neck dissection	16	0	—	—	0.5 ± 0.2
Oral and pharyngeal operations					
5. Composite resection* #	12	92	3.4 ± 1.9	1.8 ± 0.9	0.9 ± 0.0
6. Partial mandibulectomy* #	10	80	2.1 ± 1.6	0.8 ± 0.2	0.4 ± 0.0
7. Glossectomy*	11	27	2.0 ± 0.0	0.9 ± 0.3	0.3 ± 0.1
Laryngectomies					
8. Total laryngectomy* #	30	37	2.3 ± 1.2	1.1 ± 0.4	0.6 ± 0.4
9. Total laryngectomy without neck dissection	7	0	—	—	0.4 ± 0.2
10. Partial laryngectomy*	20	5	2	0.9	0.5 ± 0.3
Maxillofacial operations					
11. Maxillectomy \pm Cranio-facial resection* #	10	100	3.4 ± 2.9	2.1 ± 0.9	—
12. Lateral rhinotomy	13	15	1.3 ± 0.3	0.8 ± 0.1	0.6 ± 0.2
Parotidectomies					
13. Total parotidectomy*	23	4	2	0.9	0.6 ± 0.2
14. Superficial parotidectomy	46	0	—	—	0.3 ± 0.2

* Includes neck dissection.

Includes flap reconstruction.

In order to structure our results, the different types of surgical operations were classified in 5 groups, according to the anatomical region of the primary cancer. For each procedure the average intraoperative blood loss, the percentage of transfused patients, and the average number of transfused blood units are shown in Table I.

Neck dissections are usually classified as either radical or functional (also called modified radical neck dissection), unilateral or bilateral. All bilateral radical neck dissection patients required a transfusion, while only a quarter of the unilateral radical neck dissections patients were transfused. No case of functional neck dissection, unilateral or bilateral, received a transfusion.

The operations for oral or oropharyngeal primary cancer were all associated with some form of neck dissection. One can distinguish in this group, the operations with or without mandibular resection. The mandibular resection operations included a reconstruction part with a myocutaneous or a free micro-anastomosed flap. The composite resection patients were transfused in 92% of the cases and 8 out of 10 patients with partial mandibular resection required a blood transfusion. On the other side, only 27% of glossectomy cases underwent a transfusion.

In the laryngectomy group, the total laryngectomy or pharyngolaryngectomy patients associated with a neck dissection were transfused in 35% of cases. The

total laryngectomy without neck dissection patients never required a transfusion. Only 1 out of 20 cases of partial laryngeal surgery underwent a transfusion.

The operations for paranasal sinus primaries were divided into maxillectomy cases associated or not with a cranio-facial resection, who all necessitated a transfusion, and the lateral rhinotomy cases for which a transfusion took place only in 15% of cases.

Finally, for the total parotidectomies the rate of transfusion was 4%. There was no transfusion for a superficial parotidectomy.

Patients who had undergone previous radiation therapy had a higher blood loss, but the difference was not significant, for any of the procedures, or for the entire patient population.

These results show that there are 3 categories of surgical procedures for Head and Neck cancer, according to their probability of requiring a blood transfusion. In the first category with a high transfusion probability, a transfusion is necessary in at least 80% of the patients. This category includes the bilateral radical neck dissections, the maxillectomy operations with or without a cranio-facial resection, the composite resections, and the partial mandibulectomy procedures.

For the second category, the probability is low, inferior to 5%. These operations are partial laryngectomies, parotidectomies, the functional neck dissections (unilateral or bilateral), and total laryngectomies without an associated neck dissection.

In the third category, the transfusion probability is moderate, between 15 and 40%. The procedures involved are total laryngectomy with a neck dissection, glossectomy, unilateral radical neck dissections, and lateral rhinotomy. For the moderate transfusion probability operations, patients requiring a transfusion were significantly ($p < 0.001$) older, with a mean age of 65 ± 12 years, than non-transfused patients (56 ± 11 years). Also, transfused patients had a lower preoperative hemoglobin (124 ± 11 g/l), when compared to patients not requiring a transfusion (Hb: 150 ± 11 g/l) and the difference was significant ($p < 0.001$). Finally, they had a higher incidence of cardiovascular or pulmonary medical problems (80% vs. 28% for non-transfused patients).

The average preoperative hemoglobin and hematocrit for the transfused patients were respectively, 133.4 g/l and 40%. The average postoperative hemoglobin and hematocrit for the transfused patients were 101.9 g/l and 31%, respectively. Past medical history for cardiovascular and pulmonary diseases was present in 25% of transfused patients.

The delay between the diagnosis and the surgical intervention was on average 21 days: 7 days between the first clinic visit and the multidisciplinary tumor board and 14 days between this conference and the surgery date.

DISCUSSION

This retrospective study allowed us to identify and analyze the surgical procedures that required a transfusion in our clinic. Also, the intraoperative blood loss and the transfusion requirements for each operation were determined. Overall, these results correspond to the unique study published on the subject (17), although direct comparison is not possible because of a different classification of the primary ablative surgery and reconstruction procedure. Blood losses above 1,000 ml, which most likely require a blood transfusion, were encountered in composite resections for oral or oropharyngeal cancers, total laryngopharyngectomies, and maxillectomy procedures (17). Like our data, these procedures were associated with a larger amount of blood units transfused.

We could classify the operations according to the probability of necessitating a blood transfusion. For the procedures with a high transfusion probability, blood should be prepared beforehand because the majority of patients will require it. Inversely, preoperative blood preparation is not justifiable for the low transfusion probability operations. Finally, for the procedures with a moderate transfusion proba-

bility, our results indicate that transfused patients are older than patients who did not require a transfusion, that they have lower preoperative hemoglobin, and that they have more frequently a past medical history of cardiac and pulmonary diseases. For these operations, the probability of necessitating a blood transfusion can be evaluated by taking into account these parameters.

The preoperative hemoglobin and hematocrit values were only slightly below normal levels in our patients, showing that Head and Neck cancer patients are not anemic before surgery. Also, the low postoperative values show that our patients were not transfused in excess.

With the side effects of homologous blood transfusion in mind (2, 3), the use of autologous blood is to be considered for the operations with a high transfusion probability, as well as for selected cases in the moderate probability group.

In the elective surgical procedures, the delay between the decision to operate and the date of the operation can be extended to allow for the donation of adequate amount of blood (18). The majority of operations requiring a transfusion in Head and Neck surgery were for cancer resection. Therefore, the time available to collect blood for an autotransfusion is limited. An average delay of 3 weeks was found between the diagnosis and the date of operation. This delay appears sufficient for the donation of 2–3 blood units and this quantity of blood seems to cover the transfusional needs for the majority of our operations. Alternatively and particularly in cases with mild anemia (hemoglobin between 105 and 125 g/l), in patients with low blood volume (body weight between 30 and 50 kg), or in patients with an operation imperatively fixed in the next 8–15 days, a pre-donation program may be facilitated by the adjuvant use of recombinant human erythropoietin (19, 20).

The role of autotransfusion of cancer cells has been debated, but appear to be limited (1). Hansen et al. found apparently viable cancer cells in the venous blood during cancer resection in 26% of their patients. However, the number of circulating cancer cells was between 1 and 55 , while they recovered between 10 and 10^7 cancer cells shed in the surgical field in 93% of the same patients. Also, the collection period follows the surgical manipulation of the tumor and it is unclear that the number of circulating cancer cells is similar during a pre-operative collection. Probably the immunological consequences of homologous transfusion (21) are less detrimental than this potential risk of cancer cells autotransfusion.

REFERENCES

1. Hansen E, Wolff N, Knuechel R, Rushoff J, Hofstaedter F, Taeger K. Tumor cells in blood shed from the surgical field. *Arch Surg* 1995; 130: 387-93.
2. Beris P. Autotransfusion. *Méd et Hyg* 1994; 52: 1025-30.
3. The national blood resource education program expert program: The use of autologous blood. *JAMA* 1990; 263: 414-17.
4. Johnson JT, Taylor FH, Thearle PB. Blood transfusion and outcome in stage III head and neck carcinoma. *Arch Otolaryngol Head Neck Surg* 1987; 113: 307-10.
5. Jackson RM, Rice DH. Blood transfusion and recurrence in head and neck cancer. *Ann Otol Rhinol Laryngol* 1989; 98: 171-3.
6. Woolley AL, Hogikyan ND, Gates GA, Haughey BH, Schtechtman KB, Goldenberg JL. Effect of blood transfusion on recurrence of head and neck carcinoma. *Ann Otol Rhinol Laryngol* 1992; 101: 724-30.
7. Barra S, Barzan L, Maione A, et al. Blood transfusion and other prognostic variables in the survival of patients with cancer of the head and neck. *Laryngoscope* 1994; 104: 95-8.
8. Heiss MM, Mempel W, Delanoff C, et al. Blood transfusion-modulated tumor recurrence: first result of a randomized study of autologous versus allogenic blood transfusion in colorectal cancer surgery. *J Clin Oncol* 1994; 12: 1859-67.
9. Blumberg N, Heal JM. Transfusion and recipient immune function. *Arch Pathol Lab Med* 1989; 113: 246-52.
10. Heiss MM, Mempel W, Jauch KW, et al. Beneficial effect of autologous blood transfusion on infections complications after colorectal cancer surgery. *Lancet* 1993; 342: 1328-33.
11. Jensen LS, Andersen AJ, Christiansen PM, et al. Post operative infection and natural killer cell function following blood transfusion in patients undergoing elective colorectal surgery. *Br J Surg* 1992; 79: 513-6.
12. Busch ORC, Hop WCJ, Hoynck van Papendrecht MAW, Marquet RL, Jeekel J. Blood transfusion and prognosis in colorectal cancer. *N Engl J Med* 1993; 328: 1372-6.
13. Von Doersten P, Cruz RM, Selby JV, Hilsinger RL. Transfusion, recurrence, and infection in head and neck cancer surgery. *Otolaryngol Head Neck Surg* 1992; 106: 60-7.
14. Schuller DE, Scott C, Wilson KM, et al. The effect of perioperative blood transfusion on survival in head and neck cancer. *Arch Otolaryngol Head Neck Surg* 1994; 120: 710-6.
15. Böck M, Grevers G, Koblit M, Heim MU, Mempel W. Influence of blood transfusion on recurrence, survival and postoperative infections of laryngeal cancer. *Acta Otolaryngol* 1990; 110: 155-60.
16. Jones KR, Weissler MC. Blood transfusion and other risk factors for recurrence of cancer of the head and neck. *Arch Otolaryngol Head Neck Surg* 1990; 116: 304-9.
17. McCullogh TM, Glenn MG, Riley D, Weymuller EA. Blood use in head and neck tumor surgery. *Arch Otolaryngol Head Neck Surg* 1989; 115: 1314-7.
18. Beris P, Mermillod B, Levy G, et al. Recombinant human erythropoietin as adjuvant treatment for autologous blood donation. A prospective study. *Vox Sang* 1993; 65: 212-8.
19. Mercuriali F, Zanella A, Barosi G, et al. Use of erythropoietin to increase the volume of autologous blood donated by orthopedic patients. *Transfusion* 1993; 33: 55-60.
20. Goodnough LT, Monk TG, Andriole GL. Erythropoietin therapy. *N Engl J Med* 1997; 336: 933-7.
21. Peller S, Sayfan J, Levy Y, et al. Immunological profile changes following perioperative autologous vs. homologous blood transfusion in oncologic patients. *J Surg Oncol* 1994; 56: 98-101.

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