The Laryngoscope
Lippincott Williams & Wilkins, Philadelphia

Bilateral Radical Neck Dissection With Unilateral Internal Jugular Vein Reconstruction

Pavel Dulguerov, MD; Christian Soulier, MD; Jean Maurice, MD;
Bernard Faidutti, MD; Abdelkarim S. Allal, MD; Willy Lehmann, MD

Objective: **To describe and evaluate the functional and oncologic results of one internal jugular vein replacement after bilateral radical neck dissection (RND).** ***Study Design:*** **A retrospective historical cohort study.** ***Methods:*** **Since 1972 all patients (n = 9) undergoing bilateral RND with resection of both internal jugular veins had a reconstruction of one internal jugular vein. In six cases the RNDs were staged, and in three cases the RNDs were performed simultaneously. In every case a vascular reconstruction was performed with an autologous vein graft. All patients received radiation therapy, in five patients before and in four patients after the vein grafting. Functional results were evaluated in terms of postoperative head and neck and neurologic complications. In some patients a Doppler scan was performed to assess vein patency. Oncologic results are reported as relapse-free survival and mortality intervals.** ***Results:*** **In all patients the postoperative course was uneventful, without neurologic complications. Facial edema was noted in four patients, mild in three and moderate in one. Two patients are alive, with follow-ups of 8 and 18 years. Seven patients are dead, two without evidence of recurrence, four with cervical recurrence after a mean survival of 10 months, and one after distant metastasis after a survival of 7 years. In patients with long-term survival a Doppler scan confirmed the patency of the vein graft.** ***Conclusion:*** **The lack of operative complications and the absence of postoperative neurologic complications make a unilateral internal jugular vein replacement after bilateral RND attractive, although the oncologic results remain poor.**
***Laryngoscope,* 108:1692–1696, 1998**

From the Division of Head and Neck Surgery, Department of Otolaryngology—Head and Neck Surgery (P.D., C.S., W.L.), the Clinic of Cardiovascular Surgery, Department of Surgery (J.M., B.F.), and the Division of Radiation Oncology, Department of Radiology (A.S.A.), Geneva University Hospital, Geneva, Switzerland.

Editor's Note: This Manuscript was accepted for publication May 22, 1998.

Send Reprint Requests to Pavel Dulguerov, MD, Division of Head and Neck Surgery, Department of Otolaryngology—Head Neck Surgery, Geneva University Hospital, 24, rue Micheli-du-Crest, Geneva, CH 1205, Switzerland.

INTRODUCTION

The curative treatment of large cervical node metastasis of head and neck squamous cell carcinoma (HNSCC) most often involves a radical neck dissection (RND), followed by postoperative radiotherapy.[1] In Lindberg's series[2] of 2044 patients, bilateral cervical metastasis was clinically present in 15% of patients with an incidence varying from 5% for oral cavity primaries to 45% for carcinoma of the hypopharynx. It is generally held that bilateral nodal metastasis has a poorer prognosis; probably, therefore, a separate staging classification for bilateral nodal disease is incorporated in both the American Joint Committee on Cancer (AJCC)[3] and the Union Internationale Contre la Cancer (UICC)[4] classifications. However, several large series fail to confirm these findings,[5,6] and in the only study specifically addressing this point the survival difference between unilateral and bilateral cervical nodal disease failed to reach statistical significance.[7]

Radical neck dissection by definition removes the sternocleidomastoid muscle, the spinal nerve, and the internal jugular vein (IJV).[8] Bilateral RND can be performed during the same surgical procedure *(simultaneous RND)* or can be performed in two different operations, either because of preoperative planning *(planned staged RND)* or because of a contralateral recurrence, following the initial treatment *(salvage staged RND)*.

In the first half of the century, bilateral RND was deterred by reports of high mortality and morbidity.[9,10] Apparently, the first successful simultaneous bilateral neck dissections were performed in the early 1950s.[11] Since then, several series have been published for planned staged RND,[12,13] salvage staged RND,[13–15] and simultaneous RND.[13,14,16] Even if certain publications seem to indicate that simultaneous bilateral RND does not increase the operative mortality and morbidity, it is generally believed that bilateral RND is a safer procedure when each neck dissection is staged.[12–14,17] An interval of at least 1 month is usual, since this delay is supposed to allow the development of collateral venous drainage from the central nervous system (CNS).[11–14] It is unclear whether

longer delays decrease the complications of bilateral RND.[12]

Resection of both IJVs leads to increased intracranial pressure.[9,18] Other serious reported complications of bilateral RND include blindness,[19–23] inappropriate secretion of antidiuretic hormone,[24,25] obstruction of the upper-airway,[12,24] stroke,[12,14,15] and death.[7,10,12,14–17,26]

In the early 1970s, a patient died in our clinic of intracranial hypertension following a staged bilateral neck dissection with an interval between operations of 6 months. Since then, we have adopted the policy of reconstructing one of the jugular veins with venous replacement grafts when bilateral sacrifice of the IJV is contemplated. While IJV reconstruction after bilateral RND has been described previously,[26–29] until recently[30] none of the publications were in the otolaryngologic literature. We report our experience with nine cases of IJV reconstruction and analyze our results in the light of the relevant literature.

PATIENTS AND METHODS

Between 1972 and 1991, nine patients underwent a bilateral RND with sacrifice of both IJVs and vascular reconstruction. The clinical and oncologic data are described in Table I. Six patients had a cervical lymph node metastasis of HNSCC, two patients had a cervical lymph node metastasis from an unknown primary, and one patient had a recurrent thyroid fibrosarcoma.

Simultaneous RNDs were performed in three cases, and staged RNDs were performed in the other six cases. The delay varied between 1 and 9 months. The delay between the two neck dissections was secondary to a contralateral cervical recurrence in four cases, following a combined surgery and radiation treatment for HNSCC (salvage staged RND). In the two remaining cases the neck dissections were staged at an interval of 1 month for bilateral neck metastasis from an unknown primary carcinoma (planned staged RND). A bilateral RND was planned in seven patients because of the size and/or the fixation of the lymphadenopathy. In two other patients a functional neck dissection was initially foreseen, but an RND was performed because of intraoperative discovery of jugular vein invasion by the tumor. All patients underwent a prophylactic tracheotomy during the second RND procedure.

A graft using the greater saphenous vein was used in all nine patients. In one patient a bilateral venous grafting was performed because the first saphenous graft was judged of too-small caliber. The harvesting of the graft was performed by the cardiovascular surgeons simultaneously with the neck dissection, thereby minimizing the increase in overall duration of the procedure. The anastomosis was terminoterminal in all cases with either partial suturing of the larger IJV lumen or by slanting the cut ends of the saphenous vein to be grafted, allowing for an anastomosis of the entire IJV diameter. In the deceased patients no specific procedure was performed to demonstrate the patency of the graft and anastomosis. In the two surviving patients, patency of the graft was confirmed by Doppler ultrasound.

All patients had radiation therapy: five patients had been given preoperative irradiation and four patients underwent postoperative radiation therapy after the vascular grafting.

RESULTS

Morbidity

The postoperative course was uneventful and without neurologic complication in all cases. Facial edema was noted in four cases. In three cases the facial edema was mild and regressed in a few days; in one patient the edema was more important, but without signs of intracranial hypertension. This patient had undergone a thyroidectomy followed by neck radiation therapy 2 years previously for a thyroid fibrosarcoma, and a simultaneous RND including the paratracheal nodes was performed.

Survival

Two patients are alive, respectively, 8 and 18 years after the operation. Neither of these patients developed a recurrence. Seven patients died. Among these patients, two died of intercurrent illnesses, one at 5 weeks after surgery, of undetermined causes, and another at 10 weeks, of a pulmonary embolism. Both of these patients had an uneventful hospital stay, and no obvious relationship with the vascular graft or the operation could be demonstrated at autopsy. Four patients died with a cervical recurrence or disease progression after 4, 7, 7, and 22 months, respectively. One patient died of distant metastasis without locoregional recurrence, after 7 years (Table I). Overall, five patients remained without cervical recurrence (55%).

TABLE I.
Patient Characteristics, Treatment, Complications, and Follow-up.

Age (y)	Sex	Primary Tumor	Delay Between RND (mo)	Radiation Therapy	Post-Operative Edema	Recurrence	Recurrence Delay	Survival	Follow-Up
Staged Bilateral Neck Dissection (Planned and Salvage)									
61	M	Unknown	1	Postoperative	Mild	—		Dead	2.5 mo
68	M	Unknown	1	Postoperative	Mild	Cervical	17 mo	Dead	22 mo
51	M	Hypopharynx	3	60 Gy before	—	—		Alive	18 y
44	M	Oropharynx	4	50 Gy before	Mild	—		Dead	1 mo
49	M	Oropharynx	5	56 Gy before	—	Mediastinum	1 mo	Dead	4 mo
36	F	Nasopharynx	9	64 Gy before	—	Metastasis	4 y	Dead	7 y
Simultaneous Bilateral Neck Dissection									
72	F	Larynx	0	Postoperative	—	—		Alive	8 y
62	M	Hypopharynx	0	Postoperative	—	Cervical	1 mo	Dead	7 mo
23	M	Thyroid	0	54 Gy before	Moderate	Cervical	1 mo	Dead	7 mo

RND = radical neck dissection.

DISCUSSION

Bilateral neck dissections are performed simultaneously with increasing frequency.[7,30,31] Probably the majority of these operations are modified or selective neck dissections with preservation of at least one IJV. In these "functional neck dissections" the morbidity and postoperative complications seem to be similar whether operation is on one side of the neck or both sides.[31] Despite the progressive sophistication of radiologic imaging, metastatic lymphadenopathy is sometimes found at surgery to be in close contact with or to infiltrate one or both IJVs, as demonstrated by two of our cases and by other reports.[30] Also, several recent studies have shown discrepant patency rates in preserved IJVs after functional neck dissections: 99% for Cotter et al.,[32] 77% for Fisher et al.,[33] and only 18% after surgery and irradiation for Docherty et al.[34] Therefore, when a neck dissection is contemplated in the second side of the neck after previous contralateral "functional neck dissection," the patency of the previous jugular vein cannot be assumed with certainty.

Resection or obstruction of both IJVs leads to an impediment of the venous return from the CNS. This leads to an increased intracranial pressure as demonstrated in the early 1950s by Sugarbaker and Wiley[9] and elegantly confirmed by continuous intracranial pressure monitoring during and after staged RND by Weiss et al.[18] A sudden rise in intracranial pressure above 40 mm Hg was observed as soon as vein was ligated, followed by reflex systemic hypertension. With treatment (furosemide, sodium thiopental, hyperventilation, head elevation) the intracranial pressure normalized by the end of the procedure. The authors concluded that these physiopathologic changes should be expected, monitored, and treated emergently after bilateral RND. Other serious intracranial complications of bilateral RND include blindness (five cases have been reported[19–23]), stroke,[12,14–16] and possibly, inappropriate secretion of antidiuretic hormone[24,25] (Table II). The physiopathologic mechanism of these complications is probably related to the increased intracranial pressure, but definitive proof is still lacking.

The reported mortality rate ranges from 0% to 3% for staged RND to 10% to 14% for simultaneous RND (Table II). Also, serious complications such as cardiac arrest, carotid artery blowout, pulmonary edema, and pneumonia seem to be more frequent with simultaneous RND (Table II). In fact, several publications on "bilateral radical neck dissections" are actually modified RND with preservation of IJV on at least one side and are therefore not included in this review.[35–37]

Since the venous drainage of the face is also interrupted after bilateral RND, facial and head edema, as well as chemosis and palpebral swelling, is usual. A temporary

TABLE II.
Published Series of Bilateral Neck Dissections and the Mortality and Morbidity in Each Population

Author	Year	BRND	Mortality (%)	Blindness (%)	CVA (%)	Infection (%)	Fistula (%)	Edema (%)	Hemorrhage (%)	Other Morbidity
Salvage Staged Bilateral Neck Dissection										
McGuirt[13]	1980	63	0	0	—	—	—	Usual	—	50% of complications, details unclear
Razack[14]	1981	63	3	0	—	14	6	30	—	
Jackson[16]	1991	96	1	1 Transient	1	—	—	Usual	—	Temporary tracheotomy (frequent)
Planned Staged Bilateral Neck Dissection										
Frazell[12]	1961	141	2	0	3	60	17	20	3	Shock (7%); airway obstruction (4%); cardiac arrest (2%);
McGuirt[13]	1980	17	0	0	—	—	—	—	—	22% of complications, details unclear
Simultaneous Bilateral Radical Neck Dissection										
Moore[17]	1964	151	14	0		26	29	15	4	Cardiac arrest (1%); pulmonary edema (3%); pneumonia (4%)
McGuirt[13]	1980	11	0	0	—	—	—	Usual	—	55% of complications, details unclear
Razack[14]	1981	51	10	0	5	63	36	63	—	Carotid artery blowout (11%); pneumonia (16%); cyanosis (8%); major flap loss (5%)
Bilateral Radical Neck Dissection (Type not Detailed)										
Rufino[10]	1966	180	3	0.5	—	14	—	32	—	Chemosis (5%); headache (0.5%); hypothyroidism (3%)
Nichols[17]	1969	63	1.5	0	—	2	9	0.7	3	Seroma (1.5%)

*The list was compiled through a Medline search and references cross-checking. The reports are divided according to the timing of radical neck dissection. In two reports (Rufino[10] and Nichols[17]) it is unclear if RND were staged or simultaneous. Reports of bilateral neck dissection in which one side is modified by conserving the IJV were excluded[35–37].

BRND = number of patients undergoing bilateral RND; RND = radical neck dissection; CVA = cerebrovascular accident.

tarsorrhaphy has been advocated to prevent corneal exposure.[13] As stated by Jackson and Stell,[15] "patients and relatives should be warned of the potentially gross postoperative appearance." Also, an upper-airway obstruction because of laryngeal edema is usual, and routine tracheotomy has been advocated for a long time.[12,13,15,16]

One of our patients developed moderate facial edema without signs of intracranial hypertension. A possible explanation is the association of previous cervical radiation therapy with total thyroidectomy, in addition to the bilateral simultaneous RND. It is possible that the preservation of veins and lymphatics in the cervical midline during bilateral RND, where the operation does not extend to the upper aerodigestive tract, allows some facial drainage to occur and thereby lessens the postoperative facial edema.[11] As suggested by Takeichi et al.,[26] the association of total thyroidectomy and bilateral RND interrupts all anterior neck venous drainage.

Although our patient population is small, we did not notice any important difference in morbidity between simultaneous and staged bilateral RND, possibly because of the venous grafting procedure performed. Theoretically, grafting one IJV essentially transforms a bilateral RND into a modified radical neck dissection with respect to neurologic complications. Our initial cases were performed as staged, but as we became confident about the success of the procedure, a simultaneous bilateral RND appeared to be the method of choice in terms of operative time, patient recovery, and cost. Although the small number and the heterogeneity of our population preclude any definitive conclusion, the paucity of complications with IJV grafting appears encouraging.

Several types of material and different techniques for reconstruction of the IJV have been described. Takeichi et al.[26] used in two patients an autologous great saphenous vein and two types of synthetic vascular prosthesis, all of which thrombosed. An internal-to-external jugular vein anastomosis was finally performed and remained patent. A "spiral" saphenous graft was used by Leafstedt et al.[27] in three patients with good permeability. In this technique the saphenous vein is split longitudinally and then wrapped in a spiral fashion around a conduit of the diameter of the IJV. The edges are sewn together to form a new cylinder of wider diameter that is better adapted to the diameter of the IJV. Comerota et al.[28] reconstructed 11 patients, six with synthetic materials and five with the spiral saphenous vein graft. All but one synthetic prosthesis thrombosed, whereas four of five spiral grafts remained patent. The authors also measured pregrafting IJV stump pressures and found that all grafts in patients with stump pressures above 30 mm Hg remained patent. They questioned the need to reconstruct IJVs with stump pressure below 30 mm Hg.[28] Spiral saphenous grafts were also used by Citrin and Dasmahapatra[29] in six patients with good results. More recently, Eibling et al.[30] used segments of the contralateral, resected IJV during bilateral RND to bypass a short segment in close contact with a metastatic lymph node. Whether this is a sound oncologic technique remains to be demonstrated, but it has the advantage of simplicity.

In the aforementioned publications patients fared well with no neurologic complications and minimal facial edema. Our results are similar with the use of saphenous grafts directly adapted to the IJV, either by reduction of the IJV diameter at the sectioned end by suturing or by increasing the cut edges of the saphenous graft by slanting. The patency of the grafts was not routinely checked in our patients, but the lack of neurologic complications and the modest facial edema in most patients probably attest to the patency of the venous grafts. In the two surviving patients in whom the patency was checked by a Doppler ultrasound scan, a large diameter and good flow were demonstrated. Future studies with a larger number of patients should address this point more systematically.

CONCLUSION

We believe that simultaneous bilateral RND with grafting of one IJV is an attractive option when a bilateral RND is required by the nodal disease of the patient. We are confident about the success of the venous graft in terms of patency and believe that the postoperative morbidity is limited. Compared with published reports of bilateral RND, IJV replacement appears to be associated with lower postoperative morbidity. However, the resection of both IJV did not seem to improve the survival in our patients, and bulky cervical metastasis remains a poor prognostic sign.

BIBLIOGRAPHY

1. Million RR, Cassisi NJ, Mancuso AA, Stringer SP, Mendenhall WM, Parsons JT. Management of the neck for squamous cell carcinoma. In: Million RR, Cassisi NJ, eds. *Management of Head and Neck Cancer: A Multidisciplinary Approach.* edn 2. Philadelphia: JB Lippincott; 1994:75–142.
2. Lindberg R. Distribution of cervical lymph node metastasis from squamous cell carcinoma of the upper respiratory and digestive tracts. *Cancer* 1972;29:1446–9.
3. Beahrs OH, Henson DE, Hutter RVP, Myers MH, eds. *American Joint Committee on Cancer: Manual for Staging of Cancer.* edn 2. Philadelphia, JB Lippincott, 1988.
4. International Union Against Cancer. *TNM Classification of Malignant Tumors.* edn 4. New York: Wiley-Liss, 1997.
5. Mamelle G, Pampurik J, Luboinski B, Lancar R, Lusinchi A, Bosq J. Lymph node prognostic factors in head and neck squamous cell carcinomas. *Am J Surg* 1994;168:494–8.
6. Ellis ER, Mendenhall WM, Rao PV, Parsons JT, Spangler AE, Million RR. Does node location affect the incidence of distant metastasis in head and neck squamous carcinoma? *Int J Radiat Oncol Biol Phys* 1989;17:293–7.
7. Jones AS, Stell PM. Is laterality important in node metastasis in head and neck cancer? *Clin Otolaryngol* 1991;16:261–5.
8. Robbins KT, Medina JE, Wolfe GT, Levine PA, Sessions RB, Pruet CW. Standardizing neck dissection terminology. *Arch Otolaryngol* 1991;117:601–5.
9. Sugarbaker ED, Wiley HM. Intracranial pressure studies incident to resection of the internal jugular veins. *Cancer* 1951;4:242–50.
10. Rufino D, MacComb S. Bilateral neck dissection. *Cancer* 1966;19:1503–8.
11. Gius JA, Grier DH. Venous adaptation following bilateral radical neck dissection with excision of the jugular veins. *Surgery* 1950;28:305–21.
12. Frazell EL, Moore OS. Bilateral neck dissection performed in stages. *Am J Surg* 1961;102:809–14.
13. McGuirt WF, McCabe BF. Bilateral radical neck dissection. *Arch Otolaryngol* 1980;106:427–9.
14. Razack MS, Baffi R, Sako K. Bilateral radical neck dissection. *Cancer* 1981;47:197–9.
15. Jackson SR, Stell PM. Second radical neck dissection. *Clin Otolaryngol* 1991;16:52–8.

16. Moore OS, Frazell EL. Simultaneous bilateral neck dissection. *Am J Surg* 1964;107:565–8.
17. Nichols RT. Bilateral radical neck dissection. *Am J Surg* 1969;117:377–81.
18. Weiss KL, Wax MK, Haydon RC, Kaufman HH, Hurst MK. Intracranial pressure changes during bilateral radical neck dissections. *Head Neck* 1993;15:546–52.
19. Milner GAW. A case of blindness after bilateral neck dissection. *J Otolarygol Otol* 1960;74:880—5.
20. Torti RA, Ballantyne AJ, Berkeley RG. Sudden blindness after simultaneous bilateral radical neck dissection. *Arch Surg* 1964;88:271–4.
21. Chutkow JG, Shorbough FW, Riley FC. Blindness following simultaneous bilateral neck dissection. *Mayo Clin Proceed* 1973;48:713–7.
22. Balm A, Brown DH, DeVries W, Snow GB. Blindness: a potential complication of bilateral neck dissection. *J Laryngol Otol* 1990;104.154–6.
23. Marks SC, Jaques DA, Hirata RM, Saunders JR . Blindness following bilateral radical neck dissection. *Head Neck* 1990;12:342–5.
24. McQuarrie DG, Mayberg M, Ferguson M, Schons AR. A physiologic approach to the problems of simultaneous bilateral neck dissection. *Am J Surg* 1977;134:455–60.
25. Wenig BL, Heller KS. The syndrome of inappropriate secretion of antidiuretic hormone (SIADH) following neck dissection. *Laryngoscope* 1987;97:467–70.
26. Takeichi N, Ezaki H, Nishiki M, et al. Bilateral resection and reconstruction of internal jugular vein for thyroid carcinoma. *Jap J Surg* 1984;14:465–71.
27. Leafstedt SW, Rubensetin RB, Pallanch JF, Wilder WH. Spiral saphenous vein graft for replacement of internal jugular vein: a series of cases reports. *Angiology* 1985; 36:827–31.
28. Comerota A, Hardwick RD, White JV. Jugular venous reconstruction: a technique to minimise morbidity of bilateral radical neck dissection. *J Vasc Surg* 1986;3:322–9.
29. Citrin P, Dasmahapatra KS. Interposition spiral saphenous vein graft bypass in bilateral simultaneous radical neck dissection. *Surg Gynecol Obstetric* 1988;167:79–80.
30. Eibling DE, Snyderman CH, Weber PC, Johnson JT, Steed DL. Internal jugular vein reconstruction in bilateral radical neck dissection. *Am J Otolaryngol* 1995;16:260–4.
31. Weber PC, Johnson JT, Myers EN. Impact of bilateral neck dissection on recovery following supraglottic laryngectomy. *Arch Otolaryngol Head Neck Surg* 1993;119:61–4.
32. Cotter CS, Stringer SP, Landau S, Mancuso AA, Cassissi N. Patency of the internal jugular vein following modified radical neck dissection. *Laryngoscope* 1994;104:841–5.
33. Fisher CB, Mattox DE, Zeinreich JS. Patency of the internal jugular vein after functional neck dissection. *Laryngoscope* 1988;98:923–7.
34. Docherty JG, Carter R, Sheldon CD, et al. Relative effect of surgery and radiotherapy on the internal jugular vein following functional neck dissection. *Head Neck* 1993;15:553–6.
35. Mooney CS, Jewell W, Greenlaw R, Rush BF. Simultaneous bilateral radical neck dissection following high-level radiation therapy. *J Surg Oncol* 1969;1:335–8.
36. Ballantyne AJ, Jackson GL. Synchronous bilateral neck dissection. *Am J Surg* 1982;144:452–5.
37. Ahn C, Sindelar WF. Bilateral radical neck dissection: report of results in 55 patients. *J Surg Oncol* 1989;40:252–5.