

# Internal Jugular Vein Performance After Functional Neck Dissection and the Role of Seprafilm

*Fonksiyonel Boyun Disseksiyonu Sonrasında İnternal Juguler Ven Performansı ve Seprafilm'in Rolü*

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**Objectives:** This study was designed to investigate the postoperative internal jugular vein function after functional neck dissection and the role of Seprafilm® on postoperative healing.

**Patients and Methods:** Twenty-three patients undergoing functional neck dissection were randomly assigned to two groups. Group 1 consisted of 13 patients whose internal jugular veins were wrapped with Seprafilm. Group 2 consisted of 10 patients as the control group. Internal jugular vein function was assessed preoperatively and at three months after the operation.

**Results:** The results of the Doppler examinations revealed no significant difference in postoperative internal jugular vein function between the two groups.

**Conclusion:** Postoperative healing process does not have a significant role in postoperative internal jugular vein narrowing after functional neck dissection.

**Key words:** Jugular veins; Seprafilm; neck dissection.

**Amaç:** Bu çalışmada, fonksiyonel boyun disseksiyonu sonrasında internal juguler ven fonksiyonlarının ve Seprafilm®'in ameliyat sonrası iyileşme üzerindeki rolünün araştırılması amaçlandı.

**Hastalar ve Yöntemler:** Fonksiyonel boyun disseksiyonu yapılacak 23 hasta rastgele iki gruba ayrıldı. Birinci grupta 13 hastanın disseksiyon sonrası internal juguler venleri Seprafilm ile sarıldı. İkinci gruptaki 10 hasta kontrol grubu olarak alındı. Internal juguler ven fonksiyonları ameliyat öncesi ve sonrası üçüncü ayda değerlendirildi.

**Bulgular:** Doppler incelemesi ile her iki grubun ameliyat sonrası internal juguler ven fonksiyonları arasında istatistiksel bir fark görülmedi.

**Sonuç:** Fonksiyonel boyun disseksiyonu sonrasında, ameliyat sonrası iyileşme sürecinin internal juguler ven daralmasında önemli bir rolü yoktur.

**Anahtar sözcükler:** Juguler ven; Seprafilm; boyun disseksiyonu.

Functional neck dissection (FND) was first introduced by Suarez<sup>[1]</sup> and later popularized by Bocca and Pignataro.<sup>[2]</sup> This technique allows the removal of cellulose-adipose tissue containing the cervical lymphatic system while preserving the sternocleidomastoid muscle, the spinal accessory nerve and internal jugular vein (IJV).<sup>[3]</sup> Preservation of IJV minimizes edema,

disfigurement and discoloration of the neck.<sup>[3]</sup> During neck surgery, blood flow in IJV may be disturbed by several factors. Handling of the IJV may cause damage to endothelial lining, dissection of fascia over IJV may damage the adventitia.<sup>[3-11]</sup> Ligation and coagulation of branches may also cause IJV injury leading to thrombosis and narrowing of the lumen.<sup>[3-11]</sup> Postoperative

healing and fibrosis may result in lack of elasticity and narrowing.<sup>[7,8]</sup> The incidence of IJV thrombosis after FND ranges from 0 to 29.6% while the incidence of narrow but patent vein after FND is between 3.8-64.7%.<sup>[11]</sup> Seprafilm (Seprafilm, GENZYME Inc., Cambridge, MA, USA) is a sodium hyaluronate based adhesion barrier used in abdominal, pelvic and eye surgeries to avoid adhesions.<sup>[12-14]</sup> The aim of this study was to investigate the effects of Seprafilm, that was used to wrap the IJV after FND, on postoperative IJV function.

## PATIENTS AND METHODS

The study was conducted prospectively at the Department of Otolaryngology over a 9-month period from June 2006 to March 2007. The study group consisted of 23 patients with 20 men and 3 women (mean age 56.7 years; range 44 to 73 years) who underwent 23 FNDs for various staged malignancies involving larynx, oral cavity, tongue and thyroid gland. In all patients, primary resection of the tumor and unilateral FND was performed simultaneously. None of the patients underwent postoperative radiation therapy. Informed consent was taken from all patients. Color Doppler flow examination of the IJV was performed preoperatively and three months after the operation. All patients were evaluated at the same postoperative week. All the FNDs were performed by the same surgeon and the Doppler examinations were made by the same radiologist. The radiologist was blinded about the patient groups. Radiologic examination was performed by color-coded duplex scanner (Toshiba Aplio 80, Toshiba Japan) with 7.5

Mhz linear array transducer. IJVs were scanned in the transverse and longitudinal planes along their course. The area of IJVs at rest and during Valsalva maneuver were measured at level 3, preoperatively and three months after the operation. Lack of flow and compressibility were accepted as IJV thrombosis. Patients were randomly assigned to two groups. In group 1, 13 IJVs were wrapped with Seprafilm after FND. In group 2, no material was used to wrap 10 IJVs. Mann-Whitney U test was used to analyze the IJV area difference.

## RESULTS

Twenty-eight patients were initially enrolled in this study, 14 patients were randomly assigned to each group. Five patients (one in group 1, four in group 2) were lost to follow-up after surgery. One of the 10 patients in group 2 had complete occlusion of the IJV at postoperative Doppler examination. Data on pre- and postoperative IJV area with or without Valsalva maneuver (VM) are summarized in Table 1. Pre- and postoperative IJV area difference and IJV area difference with VM are summarized in Table 2 and 3, respectively. No statistically significant difference was found between group 1 and 2. ( $p > 0.05$  by Mann-Whitney U test).

## DISCUSSION

During neck surgery, blood flow in IJV may be disturbed by several factors. The intimal damage by instruments, ligation or coagulation of its branches, dessication of the vein by operating room light, devascularization of adventitia following removal of fascia and connective tissue

**Table 1. Descriptives**

		Seprafilm (+) (n=13)	Seprafilm (-) (n=10)
Preoperative area	Mean $\pm$ SD	0.47 $\pm$ 0.19 cm <sup>2</sup>	0.41 $\pm$ 0.22 cm <sup>2</sup>
	Median (min-max)	0.44 (0.20-0.81) cm <sup>2</sup>	0.34 (0.20-0.83) cm <sup>2</sup>
Postoperative area	Mean $\pm$ SD	0.25 $\pm$ 0.17 cm <sup>2</sup>	0.20 $\pm$ 0.18 cm <sup>2</sup>
	Median (min-max)	0.2 (0.11-0.71) cm <sup>2</sup>	0.15 (0.01-0.51) cm <sup>2</sup>
Preoperative area (VM)	Mean $\pm$ SD	0.75 $\pm$ 0.31 cm <sup>2</sup>	0.73 $\pm$ 0.39 cm <sup>2</sup>
	Median (min-max)	0.67 (0.33-1.29) cm <sup>2</sup>	0.48 (0.35-1.4) cm <sup>2</sup>
Postoperative area (VM)	Mean $\pm$ SD	0.36 $\pm$ 0.19 cm <sup>2</sup>	0.35 $\pm$ 0.23 cm <sup>2</sup>
	Median (min-max)	0.30 (0.15-0.85) cm <sup>2</sup>	0.26 (0.03-0.72) cm <sup>2</sup>

VM: Valsalva maneuver; SD: Standard deviation.

**Table 2. IJV area difference**

	Mean $\pm$ SD	Median (min-max)
Seprafilm (+) (n=13)	0.22 $\pm$ 0.15 cm <sup>2</sup>	0.28 (0.05-0.45) cm <sup>2</sup>
Seprafilm (-) (n=9)	0.21 $\pm$ 0.21 cm <sup>2</sup>	0.16 (0.08-0.63) cm <sup>2</sup>
Mann-Whitney U test	p>0.05	

SD: Standard deviation.

sheaths and early fibrosis may contribute to narrowing and thrombosis of IJV.<sup>[3-11]</sup> Some of these factors can be eliminated by meticulous surgical technique and moisturizing the IJV.<sup>[5]</sup> Several studies have revealed different thrombosis rates after FND.<sup>[4,6,15,16]</sup>

Fisher et al.<sup>[4]</sup> were the first to report two cases of occlusion and one case of narrowing on 14 IJVs after FND prospectively at postoperative weeks 2-4 with contrast-enhanced CT scan. Hundred percent patency rate with normal IJV diameter, flow rate and calibration was reported by Güneş et al.<sup>[6]</sup>

Lake et al.<sup>[15]</sup> showed 24 of 25 (97%) patients had patent veins after at least four weeks following FND.

Quraishi et al.<sup>[16]</sup> reported IJV thrombosis rates of 24.7% and 26.4% on postoperative days 1-4 and 5-14 respectively. At three month follow-up, only 5.8% remained thrombosed suggesting recanalization.

Seprafilm is a sodium hyaluronate-based adhesion barrier used in abdominal, pelvic and eye surgeries to avoid adhesions.<sup>[12-14]</sup> Seprafilm placement was associated with significant reduction in the extent and density of pelvic adhesion formation following radical oophorectomy and pelvic peritonectomy.<sup>[12]</sup> The effect of Seprafilm was confirmed by Özkan et al.<sup>[13]</sup> who showed significant decrease in postoperative adhesions between conjunctiva, muscles and sclera after strabismus surgery. Seprafilm was also proven effective in decreasing the incidence of early postoperative small bowel obstruction following gastrointestinal surgery.<sup>[14]</sup>

In this study, we aimed to study the effects of postoperative fibrosis and IJV narrowing following FND. Postoperative IJV patency

**Table 3. IJV area difference (Valsalva maneuver)**

	Mean $\pm$ SD	Median (min-max)
Seprafilm (+)	0.39 $\pm$ 0.29 cm <sup>2</sup>	0.44 (0.04-0.9) cm <sup>2</sup>
Seprafilm (-)	0.37 $\pm$ 0.39 cm <sup>2</sup>	0.31 (0.24-1.04) cm <sup>2</sup>
Mann-Whitney U test	p>0.05	

SD: Standard deviation.

rate at 3-month follow-up was 95.6% (22/23). One patient had complete occlusion of IJV. Preoperative and postoperative IJV area differences with and without Valsalva maneuver revealed no significant difference between Seprafilm and control groups.

To our knowledge, this is the first study to evaluate the effects of postoperative fibrosis on IJV narrowing following FND. Seprafilm, a well known adhesion barrier, is used by many surgeons to minimize postoperative fibrosis. These results show that postoperative healing process does not have a significant role in postoperative IJV narrowing after FND. Healing is a complex fibroproliferative response involving induction of an inflammatory process, migration and proliferation of parenchymal and connective tissue cells, angiogenesis, synthesis of extracellular matrix proteins and collagen deposition, tissue remodeling and wound contraction.<sup>[17]</sup> The repair process is influenced by many factors including the tissue environment and the extent of tissue damage, the intensity and duration of the stimulus, conditions that inhibit repair such as inadequate blood supply and presence of foreign bodies, various diseases like diabetes and treatment with steroids.<sup>[17]</sup> Constant movement of the neck may have contributed to stretching the fibrosis and inadequate blood supply avoiding postoperative IJV narrowing.

## REFERENCES

1. Suarez O. El problema de las metastasis linfaticas y alejadas del cancer de laringe e hipofaringe. *Rev Otorrinolaringol* 1963;23:83-9.
2. Bocca E, Pignataro O. A conservation technique in radical neck dissection. *Ann Otol Rhinol Laryngol* 1967;76:975-87.
3. Prim MP, de Diego JI, Fernández-Zubillaga A, García-Raya P, Madero R, Gavilán J. Patency and flow of the internal jugular vein after functional neck dissection. *Laryngoscope* 2000;110:47-50.
4. Fisher CB, Mattox DE, Zinreich JS. Patency of the

- internal jugular vein after functional neck dissection. *Laryngoscope* 1988;98:923-7.
5. Yucel EA, Orhan KS, Guldiken Y, Aydin K, Simsek T, Erdamar B, et al. Evaluation of factors concerning the patency of the internal jugular vein after functional neck dissection. *Eur Arch Otorhinolaryngol* 2003;260:35-8.
  6. Güney E, Yiğitbaşı OG, Canöz K, Oztürk M, Ersoy A. Functional neck dissection: cure and functional results. *J Laryngol Otol* 1998;112:1176-8.
  7. Zohar Y, Strauss M, Sabo R, Sadov R, Sabo G, Lehman J. Internal jugular vein patency after functional neck dissection: venous duplex imaging. *Ann Otol Rhinol Laryngol* 1995;104:532-6.
  8. de Bree R, van den Berg FG, van Schaik C, Beerens AJ, Manoliu RA, Castelijns JA, et al. Assessment of patency of the internal jugular vein following neck dissection and microvascular flap reconstruction by power Doppler ultrasound. *J Laryngol Otol* 2002;116:622-6.
  9. Cappiello J, Piazza C, Berlucchi M, Peretti G, De Zinis LO, Maroldi R, et al. Internal jugular vein patency after lateral neck dissection: a prospective study. *Eur Arch Otorhinolaryngol* 2002;259:409-12.
  10. Leontsinis TG, Currie AR, Mannell A. Internal jugular vein thrombosis following functional neck dissection. *Laryngoscope* 1995;105:169-74.
  11. Harada H, Omura K, Takeuchi Y. Patency and caliber of the internal jugular vein after neck dissection. *Auris Nasus Larynx* 2003;30:269-72.
  12. Bristow RE, Montz FJ. Prevention of adhesion formation after radical oophorectomy using a sodium hyaluronate-carboxymethylcellulose (HA-CMC) barrier. *Gynecol Oncol* 2005;99:301-8.
  13. Ozkan SB, Kir E, Culhaci N, Dayanir V. The effect of Seprafilm on adhesions in strabismus surgery-an experimental study. *J AAPOS* 2004;8:46-9.
  14. Mohri Y, Uchida K, Araki T, Inoue Y, Tonouchi H, Miki C, et al. Hyaluronic acid-carboxycellulose membrane (Seprafilm) reduces early postoperative small bowel obstruction in gastrointestinal surgery. *Am Surg* 2005;71:861-3.
  15. Lake GM 3rd, DiNardo LJ, Demeo JH. Performance of the internal jugular vein after functional neck dissection. *Otolaryngol Head Neck Surg* 1994;111:201-4.
  16. Quraishi HA, Wax MK, Granke K, Rodman SM. Internal jugular vein thrombosis after functional and selective neck dissection. *Arch Otolaryngol Head Neck Surg* 1997;123:969-73.
  17. Kumar V, Fausto N, Abbas A. Tissue renewal and repair: regeneration, healing, and fibrosis. In: Kumar V, Fausto N, Abbas A, editors. *Robbins and Cotran pathologic basis of disease*. 7th ed. Philadelphia: Elsevier Saunders; 2005. p. 87-118.