

NAZAL SEPTUM PERFORASYON TAMİRİNDE FASYA VE YAĞ DOKUSU KULLANIMI: DENEYSEL TAVŞAN MODELİ

Fascia and Fat Tissue Usage in Nasal Septal Perforation Repair: Experimental Rabbit Model

Ceyhun CENGİZ¹, Munir DEMİRCİ², Şule DEMİRCİ³, Necmi ARSLAN³, Ceren ERSOZ ÜNLÜ³, Hatice ÜNVERDİ⁴, Sema HÜCÜMENOĞLU⁴, Ethem Erdal SAMİM³

¹Department of Ear, Nose and Throat, Yozgat City Hospital, 66100, Yozgat / Turkey

²Department of Ear, Nose and Throat, Recep Tayyip Erdoğan University, Rize / Turkey

³Department of Ear, Nose and Throat Ankara Education and Research Hospital, 06340, Ankara / Turkey.

⁴Department of Pathology, Ankara Education and Research Hospital, 06340, Ankara / Turkey

Ceyhun CENGİZ, MD
Munir DEMİRCİ, MD
Şule DEMİRCİ, MD
Necmi ARSLAN, MD
Ceren ERSOZ ÜNLÜ, MD
Hatice ÜNVERDİ, MD
Sema HÜCÜMENOĞLU, MD
Ethem Erdal SAMİM, MD

İletişim:

Ceyhun Cengiz, MD
Department of Ear, Nose and Throat,
Yozgat City Hospital, 66100, Yozgat /
Turkey

Tel: +90 505 229 0667

e-mail:

cyhncngz@gmail.com

Geliş tarihi/Received: 26.04.2018

Kabul tarihi/Accepted: 04.06.2018

DOI: 10.16919/bozoktip.418287

Bozok Tıp Derg 2018;8(4):55-9
Bozok Med J 2018;8(4):55-9

ÖZET

Amaç: Bu çalışmanın amacı septum perforasyon tamirinde yeni bir metod ortaya koymaktır.

Gereç ve Yöntemler: Bu çalışmada 12 beyaz, erişkin Yeni Zelanda tavşanı kullanıldı. Tavşanlar eşit olarak iki gruba ayrıldı. Tüm tavşanlarda 4mm çaplı punch aleti (12.983 mm²) kullanılarak standart perforasyon oluşturuldu. Deney grubunda perforasyon fasya ve yağ dokusuyla kapatıldı. Kontrol grubuna herhangi bir prosedür uygulanmadı. Dört hafta sonra tavşanlar sakrifiye edildi. Dijital değerlendirme için kartilaj septum çıkarıldı. Örnekler fotoğraflandı ve perforasyon alanları fotoğraf analiz programı kullanılarak hesaplandı. Perforasyon alanındaki ortalama küçülme yönünden gruplar karşılaştırıldı.

Bulgular: Çalışma periyodunun sonunda ortalama perforasyon alanı çalışma grubunda 1.35±0.51 mm² iken kontrol grubunda 4.81±0.49 mm² idi (P<0,0009). Perforasyon alanındaki ortalama küçülme oranı sırasıyla çalışma ve kontrol grubunda 89.58 % and 62.95 % olarak bulundu (P<0.0009). Ayrıca çalışma grubunda bir örnekte total kapanma saptandı.

Sonuç: Burada tanımlanan metod septum perforasyon onarımında uygulanabilir ve efektif bir seçenektir.

Anahtar Sözcükler: *Nazal septal perforasyon; Nazal septum; Adipoz doku; Tavşan*

ABSTRACT

Purpose: The objective of this study is to present a new method in septum perforation repair.

Methods: In this study, 12 New Zealand White mature rabbits were used. The rabbits are divided into two groups equally. In all rabbits, a standard perforation was operated on nasal septum by using a 4mm-diameter punch (12.983 mm²). In the experiment group, the perforations were closed by fascia and fat tissue. Any procedure was not implemented in the control group. Rabbits were sacrificed 4 weeks later. Cartilaginous septums were removed for digital evaluation. Samples were photographed and perforation areas were calculated by using photograph analyze program. Mean decrease in perforation size between the groups were compared.

Results: At the end of the study period the mean perforation area in study group was 1.35±0.51 mm² and in control group was 4.81±0.49 mm² (P<0,0009). The mean rate of decrease in perforation size was 89.58 % and 62.95 % in experiment and control group, respectively (P<0.0009). Furthermore, a total closing was determined in a sample in experiment group.

Conclusion: The method explained here is applicable and effective choice in septal perforation repair.

Keywords: *Nasal septal perforation; Nasal septum; Adipose tissue; Rabbit*

INTRODUCTION

Nasal septum is composed of a midline cartilage/ bone covered by mucopericonchrium on both sides(1). Nasal septal perforation is an anatomical defect of septum due to composite loss of mucosa and cartilage(2). Trauma, medications, inflammatory conditions, malignancy and infections have been accused in etiology, however previous septal surgery is the most frequent cause(2). Interconnection of two nasal airways causes disturbances in nasal airflow and pressure, resulting in bleeding, crusting, obstruction, whistling and pain(3).

In case of septal perforation, tissue perfusion and wound healing are disturbed. Those factors cause persistence of perforations after repair(4). The success rates of septal perforation repair have been reported in a wide range, between 40-95%(5). Although many techniques have been used up to date, none of them is suitable to be used in every septal perforation with success(5).

In this experimental study, we aimed to investigate the effectiveness of our method in septum perforation repair.

MATERIAL AND METHODS

This experimental study was approved by local ethics committee with protocol number 279. 12 white, 15-18-week-old, adult New Zealand rabbits that weighed 2.6 – 3.6 kg (mean 3.1 kg) were divided into two groups as study and control group randomly. The animals were anesthetized with intramuscular ketamine hydrochloride (35 mg/kg) and xylazine (5 mg/kg). After vertical incision performed on the nasal dorsum nasal bone was elevated in both groups (Figure 1/A). All parts of septum could be exposure by using an incision between septum and upper lateral cartilage (Figure 1/B).

Standard perforation was performed in both groups using a 4 mm-punch (Figure 1/C-D). Perikondrial elevation was implemented on all sides of perforation (Figure 2/A). The perforation was repaired in the study group by using fat tissue obtained from the inguinal

region and fascia lata. Adipose tissue was replaced to perforation in subperikondrial plan as interpositional graft (Figure 2/B). And much bigger fascia grafts were put into the nasal cavities and they were fixed each other and septum by using transseptal sutures (Figure 2/C). One of the sutures was applied in front of perforation and the other one was applied behind the perforation. Any intervention wasn't performed in the control group. The rabbits were kept under the same laboratory conditions, and fed with the same food during the study. Four weeks later, rabbits were sacrificed and septums were removed. Then, they were photographed at the same magnification, from the same distance, and using the same camera. Perforations were analyzed with photo analysis program.

The perforation areas determined by photographic analysis were compared between groups. In order to reveal individual differences according to groups, Proc. Mean procedure was used to determine descriptive statistics including minimum, maximum, standard deviation and standard error. One-way ANOVA test was performed using Proc. GLM procedure. The results were presented as the least square means±standard error. Statistical Analysis System version 9.0 (SAS, 2002) was used for statistical analysis.

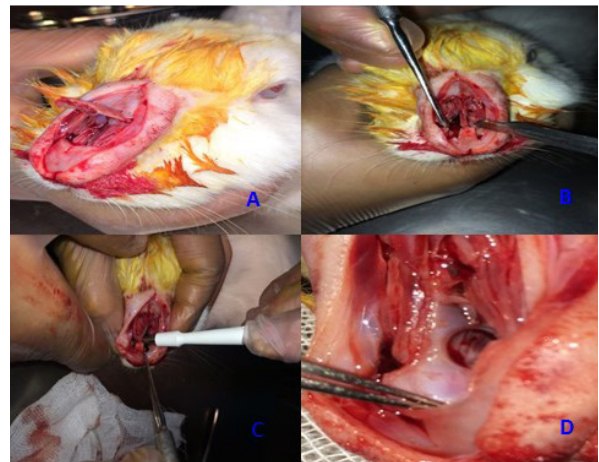


Figure 1. Exposure of the nasal cartilage and providing a standart perforation on nasal septum. Picture A; elevated nasal bone block. Picture B; incision between septum and upper lateral cartilage. Picture C; performing a perforation by using punch. Picture D; standart perforation that is provided by using punch instrument.

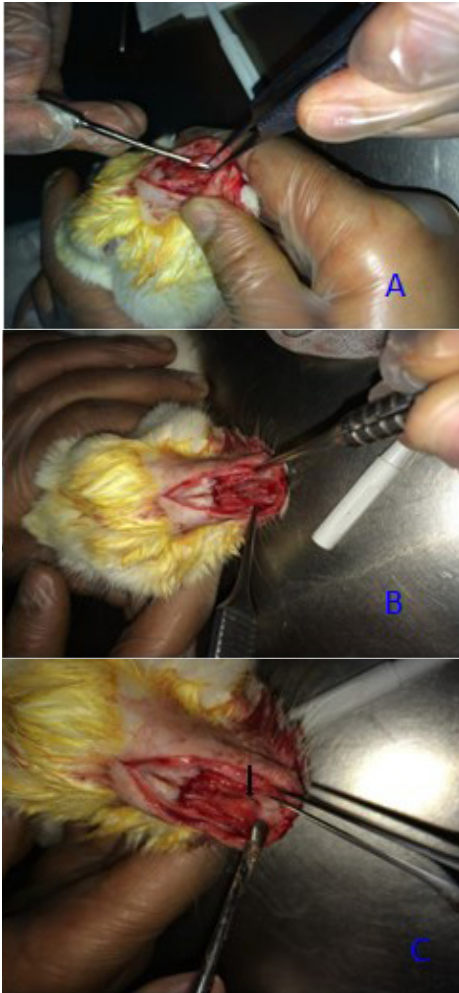


Figure 2. Perikondrial elevation and replacement of adipose tissue on in subperikondrial plan. Picture A; perikondrial elevation on all four sides of perforation. Picture B; Adipose tissue that is replaced to perforation in subperikondrial plan. Picture C; Fascia grafts are put into the nasal cavities and they are fixed each other and septum by using trans-septal sutures.

RESULTS

Standard perforation area was determined as 12,983 mm² with photo analysis program. Area calculations were performed according to this value. The mean perforation area in the study group was 1.35 ± 0.51 mm² while it was 4.81 ± 0.49 mm² in the control group at the end of study period (P<0.0009) (Table 1). The perforation healed completely in one rabbit in the study group.

The mean rate of decrease in perforation size was 89.58 ± 3.96% in the study group, and 62.95 ± 3.80% in the control group, with a statistically significant difference in between (P<0.0009) (Table 1).

Table 1. The comparison of photograph analysis results in experiment and control group.

Parameter	Experiment (n=6) Mean±SE	Control (n=6) Mean±SE	P
Area (mm ²)	1.35±0.51	4.81±0.49	<0.0001
Rate of decrease(%)	89.58±3.96	62.95±3.80	<0.0001

DISCUSSION

Septal perforation repair is challenging due to difficulty of the surgical interventions, need for surgical experience, poor tissue perfusion and wound healing(4). Although a number of surgical techniques such as inferior turbinate pedicled flap(5), tunneled sublabbial mucosal flap(6), facial artery musculomucosal flap(7), radial forearm free flap(8) and intranasal flaps have been proposed, a standard method that can be used in all perforations have not been reported up to date.

The most frequently used technique in septal perforation repair is closure of the perforation with intranasal flaps. Although intranasal flaps are the most frequently used methods in perforation repair, it is not easy to prepare flaps without injuring the mucosa. Yenigün et al. emphasized that one should avoid incision and suturing at the perforation site to preserve mucoperikondrial perfusion(9). However, every technique that employs flaps necessitates incision and suturing. The technique we described here in does not require any incision and sutures are put away from the perforation.

Although free tissue grafts were suggested to have high failure rates in perforation repair(10), some studies have reported successful results. Ismail used free composite graft obtained from the middle turbinate, and reported success in 9 of 13 patients(11). A study that used modified tragal cartilage-temporal fascia sandwich graft reported closure in 14 of

15 perforations(12). Hussain and Kay used tragal cartilage-inferior turbinate mucoperiosteum sandwich grafts, and reported their success rate as 70%(13). Our technique has also reached to the successful results.

Recent studies have shown that stem cells play a significant role in wound healing. Therefore it seems wise to use autologous materials rich in stem cells for septal perforation repair. Toyserkani et al. emphasized that fat tissue was the most accessible and rich mesenchymal stem cell source(14). It was reported that the stem cell amount in 1 g fat tissue was 500 times more than that found in 1 g bone marrow(15). It was suggested that stem cells that originated from adipose tissue supported angiogenesis, secreted growth hormone, regulated inflammation, and might be converted into different cell types(14). In addition, it was shown that stem cells that originated from adipose tissue secreted growth factors that play role in wound healing(16,17). In the present study, the success of fat tissue in closure of perforations has been associated with the aforementioned positive effects. In this method fascia is used for long term(4 weeks) stabilization of fat tissue.

In an experimental study on rabbits, thermal injury was performed in sinus mucosa, and injury was completely re-epithelized on postoperative day 29(18,19). Based on this study, we decided to sacrifice rabbits 4 weeks after surgery. On the other hand, Gabory et al. sacrificed sheep 45 days after repair of septal perforation(20). The authors stated that absence of complete closure in their study was related to shortness of this period. In another study, rabbits let alive for 50 days, and higher closure rate was obtained(21). We suppose that longer study period would enable better results in our study.

Studies on septal perforation necessitate measurements on standardized perforations. In the present study, we used a 4 mm punch for this purpose, and found it useful to obtain standard perforation. Perforations include more than 50% of the septal height that are very challenging(10) could be modeled with use of a 4 mm punch. In addition, lack of closure of perforation in any animal in the control group eliminated the doubt that affects on result of different

healing capacity in rabbits. As mentioned above, the mean decrease in perforation size was $62.95 \pm 3.80\%$ in the control group. This value is completely associated with the healing capacity of rabbits. We suppose that the healing capacity could affect the study results particularly in perforations smaller than 4 mm diameter. In addition, use of this standard equipment in future studies may enable objective comparison of the results of different studies.

Complete closure was observed in one animal in the study group, however was not seen in the control group. The mean decrease in perforation size was $89.58 \pm 3.96\%$ in the study group while it was $62.95 \pm 3.80\%$ in the control group. In literature search, we did not encounter any studies that performed such a proportionally big perforation in rabbit septum, and analyzed the perforation with photographic analysis. Therefore, we could not compare the effectiveness of our technique with the other techniques.

CONCLUSION

The number of the surgical techniques proposed for septal perforation repair increase day by day. The model presented herein may enable comparison of different techniques and allow study standardization. Besides, fascia and fat tissue usage in septal perforation repair is easy and effective method in septum perforation repair.

REFERENCES

1. Watson D, Barkdull G. Surgical management of the septal perforation. *Otolaryngol Clin N Am*. 2009;42:483-93
2. Kazkayasi M, Yalcinozan ET. Uncinate process in the repair of nasoseptal perforation. *Aesth Plast Surg*. 2011;35:878-81
3. Re M, Paolucci L, Romeo R, Mallardi V. Surgical treatment of nasal septal perforations. *Acta Otorhinolaryngol Ital*. 2006;26:102-9
4. Pedroza F, Patrocinio LG, Arevalo O. A review of 25-year experience of nasal septal perforation repair. *Arch Facial Plast Surg*. 2007;9:12-8
5. Friedman M, Ibrahim H, Ramakrishnan V. Inferior turbinate flap for repair of nasal septal perforation. *Laryngoscope* 2003;113:1425-8
6. Tardy ME. Practical suggestions on facial plastic surgery-how I do it. Sublabial mucosal flap: repair of septal perforations. *Laryngoscope*. 1977;87:275-8
7. Pribaz J, Stephens W, Crespo L, Gifford G. New intraoral flap: facial artery musculomucosal(FAMM) flap. *Plast Reconstr Surg*. 1992;90:421-9
8. Mobley SR, Boyd JB, Astor FC. Repair of a large septal perfora-

tion with a radial forearm free flap: brief report of a case. *Ear Nose Throat J.*2001;80:512

9. Yenigün A, Meric A, Verim A, Ozucer B, Yasar H, Ozkul MH. Septal perforation repair: mucosal regeneration technique. *Eur Arch Otorhinolaryngol* 2012;269:2505-10

10. Schutz-Coulon HJ. Three-layer repair of nasoseptal defects. *Otolaryngol Head Neck Surg.* 2005;132:213-8

11. Ismail HK. Closure of septal perforations. A new technique. *J Laryngol Otol* 1964;78:620-3

12. Hussain A, Murthy PJ. Modified tragal cartilage-temporoparietal and deep temporal fascia sandwich graft technique for repair of nasal septal perforations. *J Laryngol Otol.*1997;111:435-7

13. Hussain A, Kay N. Tragal cartilage inferior turbinate mucoperiosteal sandwich graft technique for repair of nasal septal perforations. *J Laryngol Otol.*1992;106:893-5

14. Toyserkani NM, Christensen ML, Skeikh SP, Sorensen JA. Adipose-derived stem cells new treatment for healing. *Ann Plast Surg.*2015;75(1):117-23

15. Fraser JK, Wulur I, Alfonso Z, Hedrick MH. Fat tissue: an underappreciated source of stem cells for biotechnology. *Trends Biotechnol.* 2006;24:150-4

16. Cai L, Johnstone BH, Cook TG, Liang Z, Traktuev D, Cornetta K et al. Suppression of hepatocyte growth factor production impairs the ability of adipose-derived stem cells to promote ischemic tissue revascularization. *Stem Cells.* 2007;25:3234-43

17. Kim WS, Park BS, Sung JH. The wound healing and anti-oxidant effects of adipose-derived stem cells. *Expert Opin Biol Ther.*2009;9:879-87

18. Swibel Rosenthal LH, Benninger MS, Stone CH, Zacharek MA. Wound healing in the rabbit paranasal sinuses after Coblation : evaluation for use in endoscopic sinus surgery. *Am J Rhinol Allergy.*2009;23:360-3

19. Swibel-Rosenthal LH, Benninger MS, Stone CH, Zacharek MA. Wound healing in the paranasal sinuses after Coblation, Part: II evaluation for endoscopic sinus surgery using a sheep model. *Am J Rhinol Allergy.*2010;24:464-6

20. De Gabory L, Delmond S, Deminiere C, Stoll D, Bordenave L, Fricain JC. Assessment of biphasic calcium phosphate to repair nasal septum defects in sheep *Plast Reconstr Surg.*2011;127:107

21. Martinez Neto EE, Dolci JE. Nasal septal perforation closure with bacterial cellulose in rabbits. *Braz J Otorhinolaryngol.* 2010;76:442-9