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Use of bacterial cellulose in closure of nasal septal perforation

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ABSTRACT

Background: 30 patients with nasal septal perforation after surgical correction of septal deviation undergoing trials of septal closure were divided into 2 groups to compare between results of free inferior turbinate graft with bacterial cellulose and results of free inferior turbinate graft only in closure of nasal septal perforation. To compare between results of free inferior turbinate graft with bacterial cellulose and results of free inferior turbinate graft only in closure of nasal septal perforation.
Methods: Prospective randomized study in which 30 patients with nasal septal perforation after surgical correction of septal deviation undergoing trials of septal closure were divided into 2 groups; group I (15 patients) in which free inferior turbinate graft with bacterial cellulose would be used in closure of nasal septal perforation; group II (15 patients) in which free inferior turbinate graft only would be used in closure of nasal septal perforation.
Results: Septal perforation healing (closure) would be in 10 patients in group I while in 6 patients in group II. Improvement in nasal obstruction, crustion, epistaxis and breathing sound in group I would be better than in group II.
Conclusions: Use of free inferior turbinate graft with bacterial cellulose would be an effective method than use of free inferior turbinate graft only in closure of nasal septal perforation.

Keywords: Septal perforation, Bacterial cellulose, inferior turbinate graft, healing

INTRODUCTION

Septal perforation is defined as a defect in the integrity of the nasal septum due to necrosis of the septal cartilage and soft tissue. It can have numerous causes, varying from benign ones to local manifestation of systemic diseases. The main cause is the iatrogenic one a complication of surgical correction of nasal septal deviation. These disorders may cause many clinical manifestations like nasal obstruction, crustation, epistaxis, smell disorders, and when the septal perforation is small in size and anterior in site, it may cause whistling sound with breathing.[1]

Although diagnosis of septal perforation is easy through nasal speculum and endoscopic examination but diagnostic work up includes many laboratory and radiological investigations after careful meticulous history taking and clinical examination to detect the cause.[2]

Along many decades, treatment of septal perforation represents a great challenge to physicians according to techniques of the surgery, and the use of auto graft or allograft and the restoration of both anatomy and function of the nose.[3]

It is proved that, the success of surgical treatment may not only depend on the closure of mucosal flaps on both sides but also on the interpositioning material that will be placed in between the mucosal flaps.[4]

Among the allografts used for the treatment of septal perforation is the bacterial cellulose film, it can be produced by the fermentation of acetobacter xylinum bacteria. It is a polysaccharide, non toxic, non pyogenic sterile film that may be used as a bandage in skin sores, burns and defect of skin donor areas.[5]

The aim of this study is to compare between results of free inferior turbinate graft with bacterial cellulose and results of free inferior turbinate graft only in closure of nasal septal perforation.

METHODS

A 30 patients aged between 18 years to and 40 years had small or moderate sized nasal septal perforation after surgical correction of septal deviation would be undergone trial of surgical repair of this septal perforation at Benha University hospital, faculty of medicine, ENT department between April 2015 to April 2018. Local ethical committee approval and informed consent were taken before the onset of the study. The patients would be selected with strict inclusion and exclusion criteria and would be divided into 2 groups:

Group I

15 patients undergoing surgical closure of nasal septal perforation with use of free inferior turbinate graft with bacterial cellulose.

Group II

15 patients undergoing surgical closure of nasal septal perforation with use of free inferior turbinate graft only.

Inclusion criteria

- Small size nasal septal perforation (less than 1 cm).
- Moderate size nasal septal perforation (from 1 cm to 2 mm).
- Anterior sited cartilaginous nasal septal perforation.
- Nasal septal perforation after surgical correction of septal deviation.

Exclusion criteria

- Large size nasal septal perforation (more than 2 cm).
- Inflamatory causes of nasal septal perforation.
- Oncogenic causes of nasal septal perforation.
- Post cocaine addiction nasal septal perforation.
- Systemic diseases like (diabetes, hypertension, hepatitis).
- Patients who would be lost during follow up period.

The bacterial cellulose film

The bacterial cellulose film would be produced on Hestrin and Schramm medium (HS medium).[6] The fermentation process performed in about 100 ml Erlenmeyer flasks that should contain 50 ml sterile medium, then it was inoculated with the content of one tube standard inoculums and it was incubated at 28-30º C for 7 days as a static culture.

The standard inoculums might be prepared by inoculating of a test tube containing 5 ml of glucose-ethanol acetic medium, with one ml of the tested culture, then to be incubated at 28-30º C about three days, this tube content should be used as standard inoculums.[7]

The prepared bacterial cellulose might be taken from the culture medium and should be washed with distilled water, then it could be transferred to a flask containing 4% NaOH and, it would be boiled at 100±5º C about 20 minutes to remove the bacterial cells. The alkali treated cellulose should be washed with distilled water and it might be bleached with 10% of hydrogen peroxide to have the maximum brightness.[8]

The prepared bacterial cellulose should be put on a filter paper trying to remove any solutions, and then it would be placed in Petri dish to be dried at 45º C in oven-dry for 3 hours to have dry bacterial cellulose graft with fine thickness (0, 3 mm).

Preoperative evaluation

Full history taking, nasal and paranasal sinus examination (endoscopic), imaging (CT scan) of the nose and Para nasal sinus.

Surgical procedures

The surgical procedures would be done according to the following steps:

- General anaesthesia with oro-endotracheal tube.
- The operation would be done with use of endoscope.
- Lidocaine and noradrenaline soaked cotton in the concentration of 1:100000 in both nasal cavities.
- Bilateral subperichondrial septum injection with the same solution.
- Trimming the edges of the septal perforation.
- Left sided anterior septal incision followed by ipsilateral subperichondrial detachment followed by contra lateral detachment of the right side.
- In group I, inferior turbinate graft that augmented by bacterial cellulose graft would be placed in between the two detached subperichondrial flaps and would be fixed in place by the use of fibrin glue.
- In group II, inferior turbinate graft only would be fixed in between the two detached subperichondrial flaps by stitches using.
- Packing and splinting of the nose.

Figure 1: Wet bacterial cellulose.

Postoperative follow up

- Packing and splinting of the nose that would be removed after 48 hours and 10 days simultaneously.
- Antibiotics with alkaline nasal douching would be used 10 days after the operation.
- Every week by use of the endoscope during the first month then every month for six months to detect the closure of the perforation.

Statistical analysis

The clinical data would be expressed as mean and standard deviation for quantitative data, frequency and distribution for qualitative data. Quantitative data would be compared using paired t test and Wilcox on test (Z-test). All data would be tabulated and analyzed using the computer program SPSS (statistical package for social science) version 20. P value <0.05 would be considered statistically significant (*) while >0.05 statistically insignificant P value <0.01would be considered highly significant (**) in all analyses.

Figure 2: Bacterial cellulose graft.

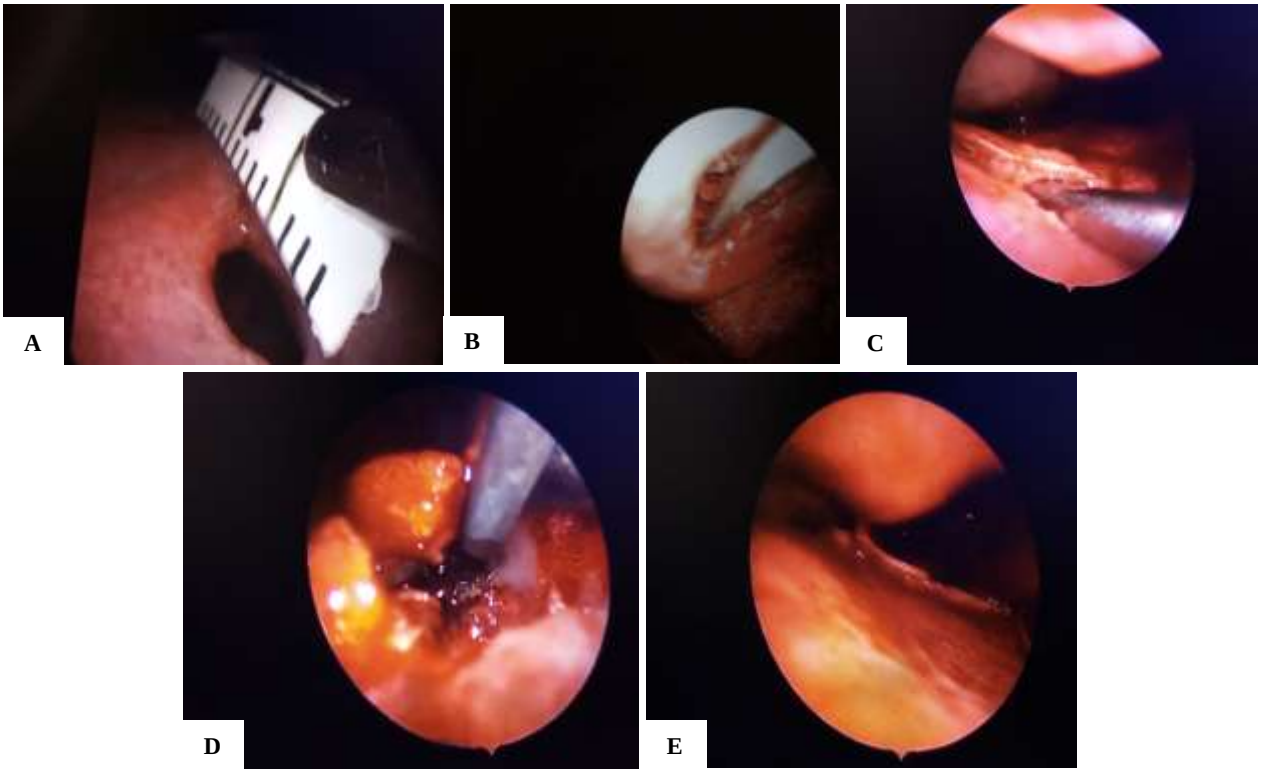

Figure 3: (A) Septal perforation less than 1 cm; (B) Trimming the edges of the septal perforation; (C) Mucoperichondrial elevation the of the septal flap; (D) Inferior turbinate graft augmented by bacterial cellulose graft group I; (E) Repaired septal perforation.

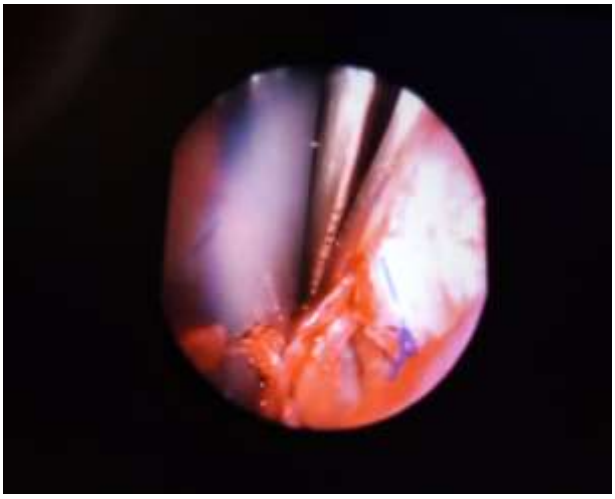

Figure 4: Inferior turbinate graft fixed by sutures with septal flaps in group II.

RESULTS

A total of 30 patients with nasal septal perforation less than 2 cm divided into two main groups were included in this study; Group I included 15 patients undergoing surgical closure of nasal septal perforation with use of free inferior turbinate graft with bacterial cellulose, 5 of them were male patients while 10 of them were female patients with mean age 28.91±0.6. There were 15 patients had nasal septal perforation before the surgery, 10 (66.7%) of them had good nasal septal perforation healing (closure) while 5 of them had bad nasal septal perforation healing (non closure) after the surgery. There were 12 (80%) patients had nasal obstruction before the surgery while 5 (33.3%) patients had nasal obstruction after the surgery. There were 10 (66.7%) patients had nasal crustation before the surgery while 4 (26.7%) patients had nasal crustation after the surgery. there were 11 (73.3%) patients had epistaxis before the surgery while 3 (20%) patients had epistaxis after the surgery, there were 8 (53.3%) patients had breathing sound before the surgery while no patients had breathing sound after the surgery.

Group II included 15 patients undergoing surgical closure of nasal septal perforation with use of free inferior turbinate graft only, 7 male patients and 8 female patients with mean age 30.08±0.7. There were 15 patients had nasal septal perforation before the surgery; 6 (40%) of them had good nasal septal perforation healing (closure) while 9 of them had bad nasal septal perforation healing (non closure) after the surgery. There were 12 (80%) patients had nasal obstruction before the surgery while 7 (46.7%) patients had nasal obstruction after the surgery. There were 9 (60%) patients had nasal crustation before the surgery while 4 (26.7%) patients had nasal crustation after the surgery. There were 12 (80%) patients had epistaxis before the surgery while 6 (40%) patients had epistaxis after the surgery. there were 7 (46.7%) patients had breathing sound before the surgery while no patients had breathing sound after the surgery.

Table 1: Distribution of study groups according to the results.

	A Group (n=15)		B Group (n=15)		Mc Nemar test	P value
	Pre ope	Post ope	Pre ope	Post ope		
	N (%)	N (%)	N (%)	N (%)		
Septal perforation healing	15 (100)	10 (66.7)	15 (100)	6 (40.0)	0.64	0.42
Nasal obstruction	12 (80)	5 (33.3)	12 (80.0)	7 (46.7)	2.12	0.15
Nasal crustation	10 (66.7)	4 (26.7)	9 (60.0)	4 (26.7)	1.23	0.27
Epistaxis	11 (73.3)	3 (20.0)	12 (80.0)	6 (40.0)	4.27	0.039*
Breathing sound	8 (53.3)	0 (0.0)	7 (46.7)	0 (0.0)	5.14	0.02*

DISCUSSION

The closure of the nasal septal perforation might be a great challenge to the rhinological surgeons.[9] There were different surgical techniques for closure of the nasal septal perforation like endoscopic, external or intranasal approach with use of combined flaps (unilateral or bilateral) or grafts (auto graft or synthetic).[10] The endoscopic approach might have the advantages of its minimal invasive technique, good exposure of the surgical field and optimal control of the septal perforation margins.[10]

The closure of the nasal septal perforation with bilateral flap might be the most important factor in the septal perforation repair, and this success could not be with use of only one flap graft.[11-16] The use of autologous nasal graft would have the advantage of maintenance of the normal physiology.[12]

The use of mucoperiosteal graft of the inferior turbinate in the repair the nasal septal perforation could integrate with the remaining septal perforation.[16] The use of buccal mucosa or skin graft in the closure of the nasal septal perforation might fail as it would lead to crusting and dry nose due to absence of the respiratory epithelium.[17]

The other endogenous grafts like tragal cartilage or temporalis fascia would be difficult to change its shape or handle it but the synthetic graft might have the high risk of graft rejection.[16,18-19]

The endoscopic techniques would be used in small and moderate size perforations (0.5-2 cm), but it might be used in closure of the large nasal septal perforations >2 cm.[16]

In this study, group I included 15 patients undergoing surgical closure of nasal septal perforation with use of free inferior turbinate graft with bacterial cellulose, 10 (66.7%) of them had good nasal septal perforation healing (closure) while 5 of them had bad nasal septal perforation healing (non closure) after the surgery. There were 12 (80%) patients had nasal obstruction before the surgery while 5 (33.3%) patients had nasal obstruction after the surgery. There were 10 (66.7%) patients had nasal crustation before the surgery while 4 (26.7%) patients had nasal crustation after the surgery. There were 11 (73.3%) patients had epistaxis before the surgery while 3 (20%) patients had epistaxis after the surgery. There were 8 (53.3%) patients had breathing sound before the surgery while no patients had breathing sound after the surgery.

The closure of the nasal septal perforation with use of the inferior turbinate graft only would have the success rate between 83% to 88%, but it might have the disadvantage of its bulk that could cause partial nasal obstruction.[9,10]

In this study, group II included 15 patients undergoing surgical closure of nasal septal perforation with use of free inferior turbinate graft only, 6 (40%) of them had good nasal septal perforation healing (closure) while 9 of them had bad nasal septal perforation healing (non closure) after the surgery. There were 12 (80%) patients had nasal obstruction before the surgery while 7 (46.7%) patients had nasal obstruction after the surgery. There were 9 (60%) patients had nasal crustation before the surgery while 4 (26.7%) patients had nasal crustation after the surgery. There were 12 (80%) patients had epistaxis before the surgery while 6 (40%) patients had epistaxis after the surgery. There were 7 (46.7%) patients had breathing sound before the surgery while no patients had breathing sound after the surgery.

CONCLUSION

Use of free inferior turbinate graft with bacterial cellulose would be an effective method than use of free inferior turbinate graft only in closure of nasal septal perforation.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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