An unusual cause of necrosis and nasal septum perforation after septoplasty: Enterobacter cloacae

M. Binar1, F. Arslan1, H. Tasli1, O. Karakoc1, A. Kilic2 and U. Aydin1
1) Department of Otolaryngology, Head and Neck Surgery and 2) Department of Medical Microbiology, Gulhane Military Medical Academy, Ankara, Turkey

Abstract

A 20-year-old man with nasal obstruction underwent septoplasty due to nasal septal deviation. Nasal packs were inserted at the end of surgery and removed 48 hours after surgery. Twenty-four hours after removal of nasal packs, there was necrosis in both sides of septal mucosa and in bilateral inferior turbinates. Nasal swab culture was performed from both nasal cavities. Enterobacter cloacae was isolated from samples. Two weeks after surgery, nasal septum perforation was unavoidable. To our knowledge, this is the first case in literature describing septal mucosal necrosis caused by this pathogen after septoplasty. Mucosal necrosis and perforation as septoplasty complications should be kept in mind, the result of causes both common and, as in the present case, unusual.

Keywords: Antibiotics, Enterobacter cloacae, necrosis, septal perforation, septoplasty

Case Report

A 20-year-old man with severe nasal obstruction applied to our Otolaryngology, Head and Neck Surgery Department. After rhinoscopic examination and detailed endoscopic evaluation, septal deviation was diagnosed and a septoplasty procedure offered. The surgery was performed under general anaesthesia following standard sterilization procedures. A Killian incision was preferred for septal deviation, and nasal packs (Merocel standard nasal dressing; Medtronic Xomed, Jacksonville, FL, USA) were inserted into the nasal cavities at the end of surgery. A single dose of 1 g cefazolin iv was administrated on the evening of the day of the operation, and a 2 × 500 mg dose of cefuroxime axetil was provided for the next 7 days. Forty-eight hours after surgery, the Merocel packs were removed. The first thing we observed after the packs’ removal was oedema of the nasal mucosa and turbinates, as is routinely seen after nasal septal surgery. No perforation of the nasal septum was observed. Twenty-four hours after removal, there were nasal purulent discharge and color change of mucosa to greyish on both sides of septum and in the inferior turbinates (Fig. 1A, B).
We performed debridement of necrotic tissue and took samples from necrotic septal mucosa and left inferior turbinate for histopathologic and microbiologic analysis. During 5 days we continued to apply debridement and cleaning of nasal passages by suction, while also supporting the patient with systemic antibiotic therapy (cefazolin 1 g iv twice a day). Finally, 8 days after surgery (at which time there was still no perforation), we inserted a silicone nasal splint to prevent nasal synechia. The histopathologic analysis of samples was reported as inflammation and necrosis, and *Enterobacter cloacae* was identified by the BD Phoenix automated system (BD Diagnostic Systems, Sparks, MD, USA).

Antibiotic susceptibility was performed by the BD Phoenix automated system and was interpreted according to Clinical Laboratory Standards Institute criteria. *E. cloacae* was susceptible to trimethoprim/sulfamethoxazole (minimum inhibitory concentration (MIC) ≤ 1/19 mg/L), meropenem (MIC ≤ 0.5 mg/L), imipenem (MIC ≤ 1 mg/L), gentamicin (MIC ≤ 2 mg/L), ertapenem (MIC ≤ 0.25 mg/L), ciprofloxacin (MIC ≤ 0.5 mg/L), ceftriaxone (MIC ≤ 1 mg/L), cefazidime (MIC ≤ 1 mg/L), ceftazidime (MIC ≤ 1 mg/L), cefepime (MIC ≤ 1 mg/L) and amikacin (MIC ≤ 8 mg/L) and was resistant to cefoxitin (MIC > 16 mg/L), cefazolin (MIC > 8 mg/L) and ampicillin-sulbactam (MIC > 8/4 mg/L). We thus changed the antibiotic to ciprofloxacin because *Enterobacter* are intrinsically resistant to ampicillin, amoxicillin, amoxicillin-clavulanate, first-generation cephalosporins and cefoxitin owing to the production of constitutive AmpC β-lactamase. After a week we removed the silicon splints and finally observed normal, healthy color of mucosa on inferior turbinates, but unfortunately with perforation of the anterior septum 15 × 10 mm in diameter (Fig. 1C).

**Discussion**

Because septoplasty is one of the most common surgical procedures in rhinology practice, complications of this surgery are also variable. Surgeon experience, attentive surgery and exact preoperative preparation usually prevent complications. Continuous complaints of subjective nasal obstruction, bleeding, septal hematoma, septal perforation and synechial bands are often present after surgery; most of these are easy to overcome [1,2].

Mucous membranes are traumatized during septoplasty, an invitation to infections and bacteraemia by the vascular route within the nasal mucous membranes [2]. In the study of Makitie et al., the rate of local infection and septal abscess after septoplasty was 12%; on the other hand, Yoder and Weimer showed minor nasal infections only in five patients (0.48%) in a large nasal septal surgery series comprising 1040 patients [3,5]. Rare but severe complications such as toxic shock syndrome, endocarditis, osteomyelitis, meningitis and cavernous sinus thrombosis may also occur after surgery. Most of these serious infections are caused by *Staphylococcus aureus*, which is found in normal nasal microbial flora in approximately 50% of individuals [3,4,6].

Okur et al. investigated the incidence of bacteraemia during septoplasty and septrhinoplasty procedures by analysing the nasal and blood cultures taken preoperatively, intraoperatively and postoperatively [7]. In cultures taken from nasal swabs, coagulase-negative staphylococci were the most frequently isolated bacteria (65%), followed by *S. aureus* with or without other organisms (35%). Even though all preoperative and postoperative blood culture specimens were negative, bacterial growth was observed in five of 60 blood cultures taken intraoperatively, three of which were coagulase-negative staphylococci, one *Escherichia coli* and the other *S. aureus*. They also mentioned that patients with demonstrated bacteraemia from intraoperative blood cultures did not show any clinical sign of focal or systemic infection. In the other study, isolated bacteria from blood cultures taken immediately after surgery and 48 hours after surgery were similar to those that were found in nasal smear cultures except two pathogens.
peptostreptococci and Candida spp., which were also isolated from blood cultures [8].

The use of prophylactic antibiotics in rhinologic surgery is preferred by most physicians. However, the most recent studies have demonstrated that there is still not strong evidence to use antibiotics for every septal surgery. Caniello et al. did not observe significant differences in the their study groups—patients who did or did not receive antibiotics after surgery—for fever, purulent secretion and infections; therefore, they suggested that nasal surgeries are clean contaminated and do not need antibiotic prophylaxis because of low infection risk [9]. The study of Ricci and D’Ascanio, consisting of 630 patients, showed that septoplasty procedures that used antibiotics did not differ from those that did not in terms of infection development [10].

Antibiotics are usually sufficient for preventing infections, but sometimes different pathogens can cause difficult situations for both surgeon and patient. E. cloacae is a facultative Gram-negative proteobacterium belonging to the Enterobacteriaceae family [11]. Bacteria of the Enterobacter genus are widely found in nature; they are saprophytic in the environment, as they are found in soil and sewage, and are also part of the commensal enteric flora of the human gastrointestinal tract. Enterobacter cloacae, Enterobacter agglomerans and Enterobacter aerogenes have been found to multiply faster in 5% dextrose than Escherichia coli, Pseudomonas aeruginosa, Proteus spp. and Staphylococcus spp. Enterobacter spp. now pose a much broader nosocomial problem, causing a wide variety of infections. Overviews of Enterobacter infections suggest that common reservoirs for the organism include the urinary, respiratory and gastrointestinal tracts, in addition to surgical and burn wounds [12,13].

In the study of Hulterström et al., the most prevalent finding in nasal septal mucosa was aerobic irregular Gram-positive rods suggestive of Corynebacterium (58%); coagulase-negative staphylococci colonization was 53%, S. aureus 13% and Enterobacteriaceae 3% [14]. The study of Frank et al. showed that Proteobacteria (e.g. Enterobacter spp.) was 4% in anterior nares swabs in healthy adults [15].

Yoo et al. performed a retrospective review of 363 consecutive adult patients who underwent preoperative nasal swab testing and rhinoplasty or septorhinoplasty (174 primary rhinoplasty, 189 revision rhinoplasty). In the study design, first they identified endogenous nasal flora preoperatively, then pathogenic bacteria treated with culture-directed antibiotics. They found that 78.2% of patients had normal flora; 10.7% had S. aureus; and 0.28% had methicillin-resistant S. aureus. In 7.4% of patients, faecal coliforms including Escherichia coli, Enterobacter spp., and Citrobacter spp. were found. They stated that age, sex, smoking, the use of oral contraceptives and the presence of seasonal allergies did not significantly change the nasal flora or the postoperative infection rate. Patients with adult acne were found to have an increased incidence of colonization with faecal coliforms (43.8%; p <0.001) [16].

We did not assess patients’ nasal flora before surgery, so we did not perform any tests learn whether E. cloacae was a member of patient’s nasal flora. Nevertheless, we cannot exclude the possibility that the infection might have developed by means of horizontal transmission. In the prospective epidemiologic study of Flynn et al. on patients undergoing one type of surgery, most Enterobacter infections developed in patients who already had Enterobacter spp. as part of their endogenous flora. Horizontal transmission was responsible for only two of 12 Enterobacter infections [17].

To our knowledge, the present case is the first in the literature to describe E. cloacae as a cause of necrosis of the nasal septal mucosa. We could not achieve progress by using antibiotics (single-dose cefazolin iv on the surgery day and cefuroxime axetil po on the following days), which many physicians usually prefer after septoplasty. After isolation of Enterobacter infection, we changed the antibiotic to ciprofloxacin because the bacterium has an intrinsic resistance to ampicillin, amoxicillin and cephalosporins [18]. Many intensive care physicians would agree that the excessive use of broad-spectrum antibiotics, especially cephalosporin agents, has contributed to the emerging prominence of Enterobacter spp. as important nosocomial pathogens [19]. Even 2 days of cefazolin prophylaxis before surgery was associated with a significantly higher rate of Enterobacter colonization than that seen in patients who did not receive antibiotic prophylaxis (p 0.001) [17].

Most isolates of E. cloacae are susceptible to trimethoprim/sulfamethoxazole, fluoroquinolones, chloramphenicol, tetracyclines, aminoglycosides, piperacillin-tazobactam and carbapenems. If they produce extended-spectrum β-lactamase, they become resistant to fourth-generation cephalosporins; there are thus concerns about spread of carbapenemase-producing E. cloacae [20]. Although ciprofloxacin treatment was one of the best alternatives for his pathogen, nasal septum perforation was unavoidable. There are also some reports explaining low resistance to fluoroquinolones by the mechanisms consisting of target mutations for DNA gyrase and topoisomerase IV, decreasing permeability or augmenting expression of efflux pumps [20–21].

What was the mechanism of necrosis in the present case? E. cloacae strains produce enterotoxins, α-hemolysin and thiol-activated pore-forming cytotoxins similar to Shiga-like toxin II; thus, it involves curli fimbriae in the formation of biofilms. Genes of type III secretion system, which delivers toxins into the host cells, were found in E. cloacae strains and contribute to its pathogenesis [20].
Conclusion

Necrosis resulting in nasal septum perforation after septoplasty is infrequent. It is surprising that unusual pathogens such as Enterobacter cloacae, which probably has low colonization in nasal mucosa, can cause this bothersome situation. Antibiotic prophylaxis with first- or second-generation cephalosporins was not adapted in this case because E. cloacae is known to be naturally resistant to these agents. All rhinology surgeons must be aware of different infectious pathogens in the aetiology of necrosis after septoplasty to prevent further complications such as nasal septal perforation. In case of postoperative infection, nasal swab cultures must be taken, and oral wide-spectrum antibiotics should be administered until the specific pathogen is identified by microbiologic analysis.

Conflict of Interest

None declared.

References

[1] Ketcham AS, Han JK. Complications and management of septoplasty. Otolaryngol Clin N Am 2010;43:897–904.
[2] Bloom JD, Kaplan SE, Bleier BS, Goldstein SA. Septoplasty complications: avoidance and management. Otolaryngol Clin N Am 2009;42:463–81.
[3] Makitie A, Aaltonen LM, Hytonen M, Malmberg H. Postoperative infection following nasal septoplasty. Acta Otolaryngol Suppl 2000;543:165–6.
[4] Bandhauer F, Buhl D, Grossenbacher R. Antibiotic prophylaxis in rhinosurgery. Am J Rhinol 2002;16:135–9.
[5] Yoder MG, Weimert TA. Antibiotics and topical surgical preparation solution in septal surgery. Otolaryngol Head Neck Surg 1992;106:243–4.
[6] Wertheim HF, Melles DC, Vos MC, van Leeuwen W, van Berkum A, Verbrugh HA, et al. The role of nasal carriage in Staphylococcus aureus infections. Lancet Infect Dis 2005;5:751–62.
[7] Okur E, Yildirim I, Aral M, Ciragil P, Kiliç MA, Gul M. Bacteremia during open septorhinoplasty. Am J Rhinol 2006;20:36–9.
[8] Kaygusuz I, Kizirgil A, Karlıdağ T, Yalçın S, Keles E, Yakupogulları Y, et al. Bacteremia in septoplasty and septorhinoplasty surgery. Rhinology 2003;41:76–9.
[9] Canello M, Passerotti GH, Goto EY, Voegels RL, Butugan O. Antibiotics in septoplasty: is it necessary? Rev Bras Otorrinolaringol 2005;71:734–8.
[10] Ricci G, D’Ascanio L. Antibiotics in septoplasty: evidence or habit? Am J Rhinol Allergy 2012;26:194–6.
[11] Liu WY, Wong CF, Chung KM, Jiang JW, Leung FC. Comparative genome analysis of Enterobacter cloacae. PLoS One 2013;8:e74487.
[12] Ristuccia PA, Cunha BA. Enterobacter. Infect Control 1985;6:124–8.
[13] Rotter G, Rice D, Offlee L. Enterobacter. J Nosocomial Infect 1988;5:9–10, 17–18.
[14] Hulterstrom AK, Sellin M, Berggren D. The microbial flora in the nasal septum area prone to perforation. J Am Acad Dermatol 2012;66:1016–24.
[15] Frank DN, Feazel LM, Bessesen MT, Price CS, Janoff EN, Pace NR. The human nasal microbiota and Staphylococcus aureus carriage. PLoS One 2010;5:e10598.
[16] Yoo DB, Peng GL, Azizzadeh B, Nassif PS. Microbiology and antibiotic prophylaxis in rhinoplasty: a review of 363 consecutive cases. JAMA Facial Plast Surg 2015;17:23–7.
[17] Flynn DM, Weinstein RA, Nathan C, Gaston MA, Kabinis SA. Patients’ own flora as the source of ‘nosocomial’ Enterobacter in cardiac surgery. J Infect Dis 1987;156:363–8.
[18] Keller R, Pedrosa MZ, Ritchmann R, Silva RM. Occurrence of virulence-associated properties in Enterobacter cloacae. Infect Immun 1998;66:645–9.
[19] Weinstein RA. Endemic emergence of cephalosporin resistant Enterobacter: relation to prior therapy. Infect Control 1986;7:20–3.
[20] Mezzatesta ML, Gona F, Stefani S. Enterobacter cloacae complex: clinical impact and emerging antibiotic resistance. Future Microbiol 2012;7:887–902.
[21] Ruiz J. Mechanisms of resistance to quinolones: target alterations, decreased accumulation and DNA gyrase protection. J Antimicrob Chemother 2003;51:1109–17.