

In response to the “Letter to the Editor” on the paper “Effect of surgery, delivery device and head position on sinus irrigant penetration in a cadaver model”

Francesco MOZZANICA^{1,2}, Andrea PRETI^{1,3*}, Francesco BANDI^{4,5}, Enrico FAZIO⁴, Arianna CARDELLA^{1,2}, Stefania GALLO⁴, Chiara BULGHERONI⁶, Arkadi YAKIREVITCH⁷, Roberto GERA¹, Paolo CASTELNUOVO^{4,5}.

AFFILIATIONS

1 Department of Otorhinolaryngology, Ospedale San Giuseppe IRCCS Multimedica, Milano, Italy

2 Department of Clinical Sciences and Community Health, University of Milan, Milan, Italy

3 Department of Medicine and Surgery, University of Insubria, Varese, Italy

4 Department of Otorhinolaryngology, ASST Sette Laghi, Varese, Italy

5 Department of Biotechnology and Life Sciences, University of Insubria, Varese, Italy

6 Department of Otorhinolaryngology, Ospedale di Desio, Monza Brianza, Italy.

7 Department of Otorhinolaryngology - Head and Neck Surgery, Sheba Medical Center and Sackler School of Medicine, Tel Aviv University, Israel

*Corresponding author

Andrea Preti

Department of Medicine and Surgery, University of Insubria,

Via Guicciardini 9, 21100, Varese, Italy.

Email: andrea.preti87@gmail.com

Telephone: 00393489156197.

FAX: +39 0332 393640

Dear Editor,

We are first of all pleased to have allowed us to comment on the Letter to the Editor regarding our paper entitled “Effect of surgery, delivery device and head position on sinus irrigant penetration in a cadaver model” [1]. We read with interest the letter commenting on our article and we thank for interesting comments and the possibility to discuss some ideas of our work in more detail.

In our article we used direct intra-sinus endoscopic visualisation in order to analyse the combined effect of head position, extent of surgery, and delivery device on the delivery of topical irrigation into the paranasal sinuses. This is the first report analysing these three factors at the same time.

As far as the head position is concerned, in our study the “nose-to-sink” (NtS, nose facing 45° downward) and the “vertex down” (VD, nose facing 90° downward) positions were evaluated. We found that head position significantly affects the irrigation of the frontal sinus (which improved in the VD position), while it did not influence the distribution of the irrigant within the maxillary and sphenoid sinuses. Craig et al. [2] used a computational fluid dynamics model to compare the irrigant penetration according to head position and found that sphenoid sinus irrigation was increased using the “nose-to-ceiling” (NtC, nose facing 90° upward) position because of the effect of gravity. This datum is difficult to compare because in our study we focused only on the positions more frequently recommended by the commercial products for nasal irrigation currently available. However, since several authors agree on the significant effect of head position on the irrigant penetration [1-4], it is possible that in the clinical practice additional head positions could be suggested in order to assure the best possible mechanical lavage and medication delivery to specific sinuses (for example NtC for the sphenoid and VD for the frontal sinus).

It must be noted that, even if both the NtS and VD positions tested in our study require irrigation against gravity, a satisfactory irrigation of the sphenoid sinus was nevertheless

obtained using the squeeze bottle (from “trickle through the ostia” for step 1 of surgery, to “free flow” for step 3 of surgery according to the scale we used to evaluate the amount of irrigant entering each sinus), while the gravity dependent device and the syringe assured less brilliant results. We consequently agree with the authors of the Letter to the Editor who concluded that if the delivery device provides a volume of irrigant sufficiently large enough to fill the nasal cavity, and a pressure able to propel the irrigant into the paranasal sinuses, then the positioning of the head would be a secondary consideration.

In our study, a positive effect of surgery was demonstrated for the frontal sinus, even if no significant differences between Draf IIa and Draf III were found. This datum suggests that Draf III does not assure a significant increase of the distribution of irrigant within the sinus. We hypothesized that this phenomenon might be related to the removal of the upper portion of the nasal septum which shunts the flow of solution before it reaches the sinus. This hypothesis is in line with the findings of Zhao et al. [5] who used computational fluid dynamics to evaluate the impact of septal removal during Draf III and reported a premature spillage of the irrigant across the resected septum with a consequent reduction of frontal penetration. However, Barham et al. [6] demonstrated that Draf III procedure was superior to Draf IIa for topical irrigation of the frontal sinus. It is possible that these diverging results might be related to the small number of cadaver heads included for the analysis. Further studies are consequently needed in order to better understand the role of surgery in the distribution of irrigant within the frontal sinus.

References

1. Mozzanica F, Preti A, Bandi F, Fazio E, Cardella A, Gallo S, Bulgheroni C, et al. Effect of surgery, delivery device and head position on sinus irrigant penetration in a cadaver model. *J Laryngol Otol.* 2021;135:234-240. <https://doi.org/10.1017/S0022215120002662>.
2. Craig JR, Palmer JN, Zhao K. Computational fluid dynamic modelling of nose-to-ceiling head positioning for sphenoid sinus irrigation. *Int Forum Allergy Rhinol* 2017; 7:474–479.
3. Beule A, Athanasiadis T, Athanasiadis E, Field J, Wormald PJ. Efficacy of different techniques of sinonasal irrigation after modified Lothrop procedure. *Am J Rhinol Allergy* 2009;23:85–90.
4. Singhal D, Weitzel EK, Lin E, Feldt B, Kriete B, McMains KC et al. Effect of head position and surgical dissection on sinus irrigant penetration in cadavers. *Laryngoscope* 2010;120:2528–31.
5. Zhao K, Craig JR, Cohen NA, Adappa ND, Khalili S, Palmer JN. Sinus irrigations before and after surgery – visualization through computational fluid dynamics simulations. *Laryngoscope* 2016;126:E90–6
6. Barham HP, Hall CA, Hernandez SC, et al. Impact of Draf III, Draf IIb and Draf IIa frontal sinus surgery on nasal irrigation distribution. *Int Forum Allergy Rhinol.* 2019;00:1-4.