

Association between Maximum Tongue Pressure and FEES Findings in patients with Amyotrophic Lateral Sclerosis

Nicole Pizzorni¹, Daniela Ginocchio², Federica Bianchi², Sarah Feroldi², Miriam Vedrodyova², Gabriele Mora², Antonio Schindler¹

¹Department of Biomedical and Clinical Sciences "Luigi Sacco", University of Milan, Milan, Italy

²ALS Center, Istituti Clinici Scientifici Maugeri IRCCS, Milan, Italy

Background

Decreased tongue pressure has been reported to be a sign of bulbar involvement in patients with ALS and to be an independent prognostic factor of survival in this population (Weikamp *et al*, 2012). Whether the association with poor survival is ascribable to dysphagia's complications or to a faster progression of lower motor neuron involvement has still to be determined.

To date, the association between maximum tongue pressure (MTP) and dysphagia has been poorly studied in patients with ALS. Hiraoka *et al* (2017) identified a MTP <21 kPa as the cut-off for the onset bulbar signs (speech, salivation, and swallowing impairment). Moreover, the authors reported a reduced MTP in patients with post-swallow pharyngeal residue with 3ml semisolid bolus. However, no data are available on other consistencies and on the association with penetration and aspiration.

Aims

1. Describe the signs of dysphagia in patients with ALS with different bolus type during fiberoptic endoscopic evaluation of swallowing (FEES)
2. Analyze the association between MTP and signs of dysphagia during FEES

Results



55 patients with ALS
30 males and 25 females
Age 67.8 ± 10 years
39 spinal onset, 16 bulbar onset
Disease duration 4.2 ± 4.8 years

MTP was on average 29.7 ± 14 kPa (4-66)

ALSFERS-R total was 27.4 ± 8.6 (8-41) and bulbar was 8.4 ± 3 (0-12)

BMI was 23.4 ± 3.8 (14.7-33.1)

FOIS 16 patients free oral diet (Level 7)

26 patients restricted oral diet with multiple consistencies (15 Level 6, 11 patients Level 5)

13 patients oral pureed diet (Level 4)

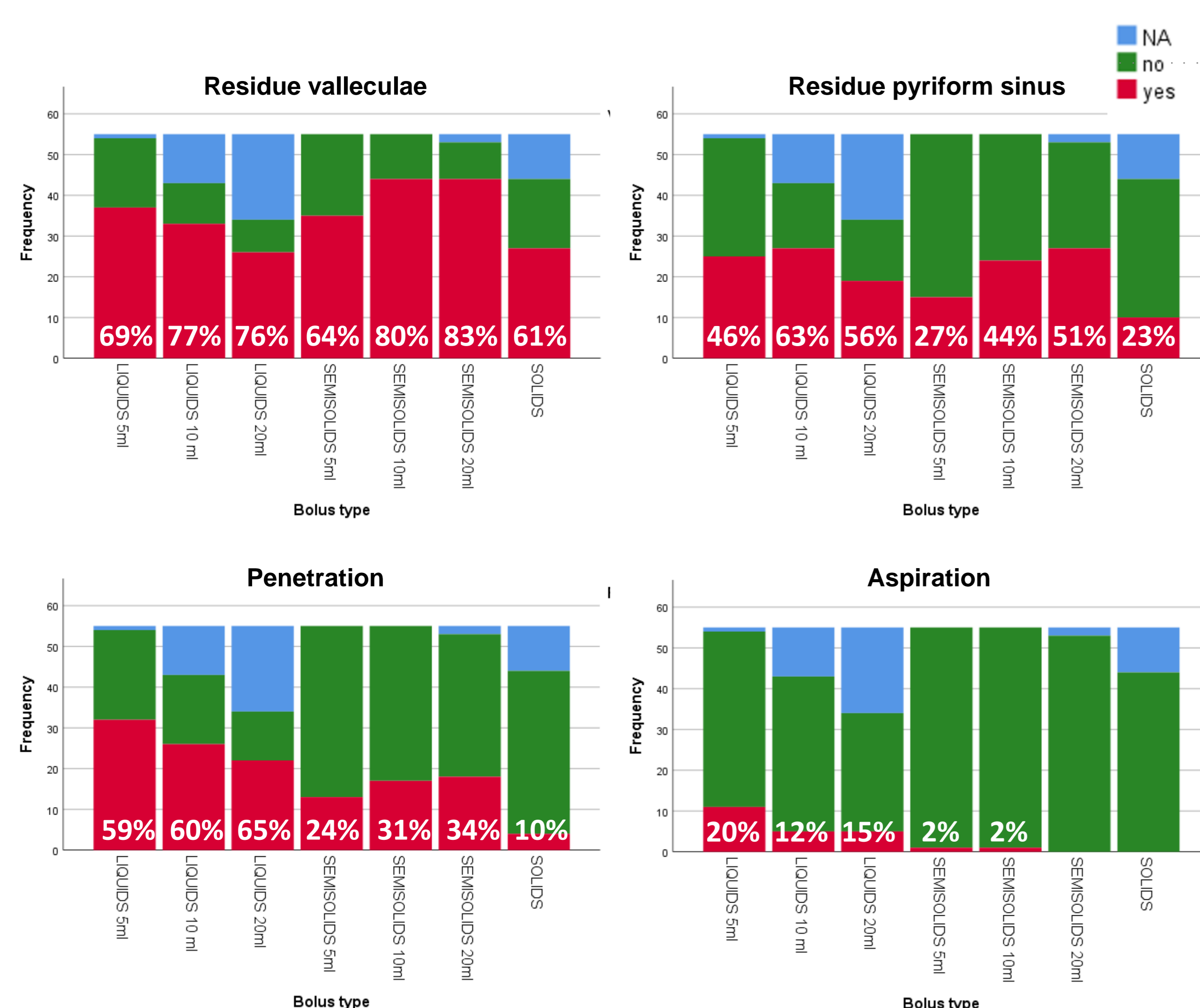


Figure 1. Frequency of signs of dysphagia on FEES with different bolus consistencies and volumes

NA = Bolus type not assessed due to safety reasons

Percentage of signs of dysphagia in tested patients is reported in the figure

Residue in the valleculae was the more common finding. Residue in the pyriform sinus increased with bolus volume. Penetration mainly occurred with liquids and remained stable among different volumes.

Methods

Study design Prospective cohort study with consecutive recruitment (March 2017 - December 2018)

Population **Inclusion criteria** Diagnosis of definite, possible, clinically probable, or clinically probable laboratory-supported ALS based on the Revised El Escorial criteria, full oral nutrition.

Exclusion criteria History of head and neck cancer, known gastrointestinal diseases, other concomitant neurological diseases.

Data acquisition

Patients were assessed by a neurologist for disease severity using the **ALS Functional Rating Scale-Revised (ALSFERS-R)**. Typical oral intake was recorded using the **Functional Oral Intake Scale (FOIS)**. **Body Mass Index (BMI)** was calculated for all patients.

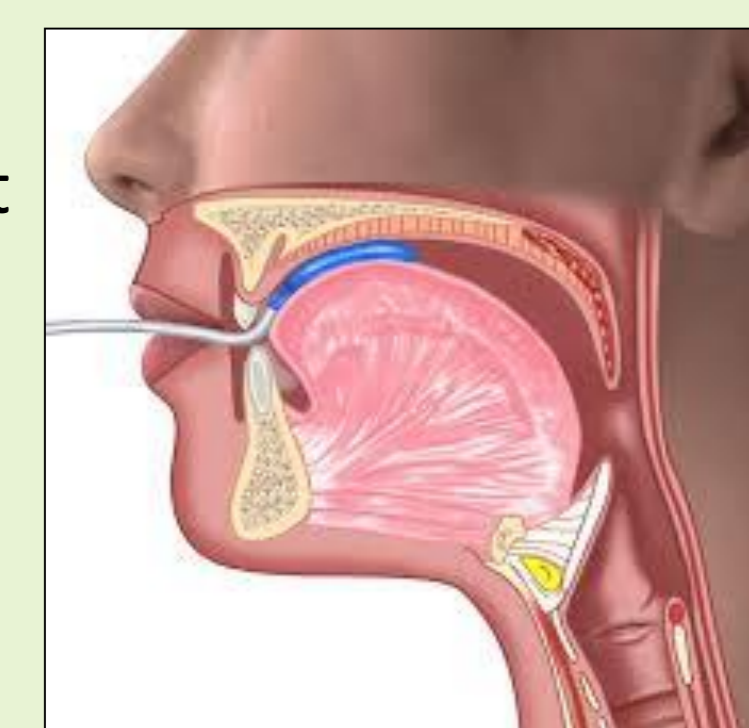


FEES protocol

5ml, 10ml, 20ml liquid x 3
5ml, 10ml, 20ml semisolid x 3
½ cracker x 2

MTP

Iowa Oral Performance Instrument
3 trials with 30 s resting period
Highest measurement



FEES analysis

Two raters scored the Penetration-aspiration scale (PAS) and the Yale Pharyngeal Residue Severity Rating Scale (YPRSRS). Patients were dichotomized for the presence of signs of dysphagia during FEES as follows:

Residue in the valleculae YPRSRS valleculae > 2

Residue in the pyriform sinus YPRSRS pyriform sinus > 2

Penetration PAS > 2

Aspiration PAS > 5

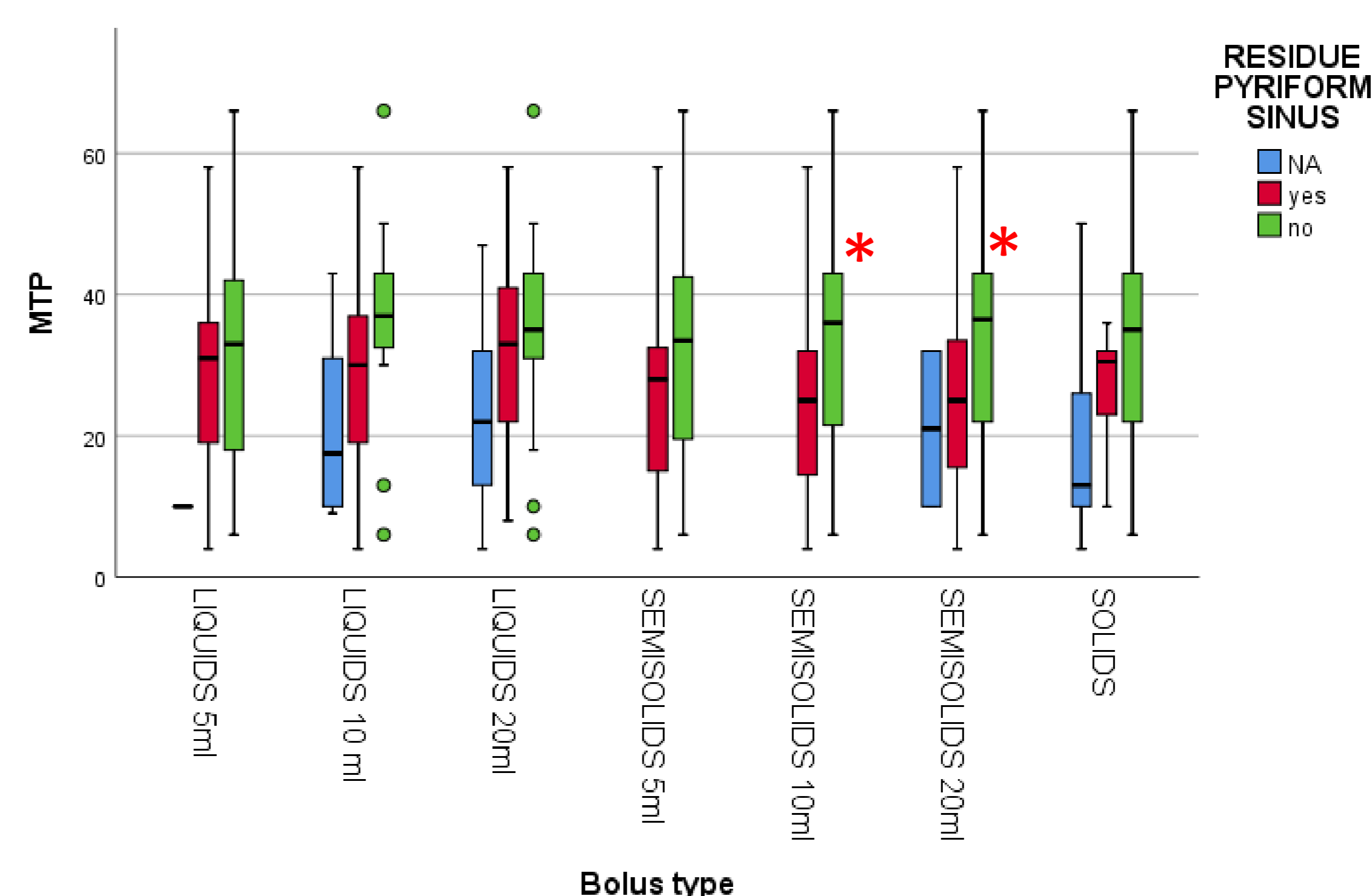


Figure 2. MTP comparisons between patients with and without residue in the pyriform sinus

NA = Bolus type not assessed due to safety reasons

Patients with **residue in the pyriform sinus** had a significantly **lower MTP** than patients without residue in the pyriform sinus with semisolids 10ml (p=0.011) and 20 ml (p=0.014).

No significantly different MTP was found for other signs of dysphagia (**residue in the valleculae, penetration, and aspiration**).

Patients that were not assessed showed a significantly lower MTP than patients assessed with no sign of dysphagia for residue in both sites and penetration with 20ml liquids and solids

Correlations A significant positive correlation was found between **MTP** and **severity of bulbar signs** (**r=0.434**, p=0.001) and between MTP and **type of oral intake** (**r=0.427**, p=0.001).

Moreover, **BMI** significantly correlated to residue in the pyriform sinus with **solids** (**r=-0.369**, p=0.014).

Conclusions

In patients with ALS, swallowing efficiency was more impaired than swallowing safety. MTP is significantly associated with residue in the pyriform sinus (especially with more viscous consistencies and increased volumes), but not with residue in the valleculae or lower airways invasion. The association between decreased MTP and residue in the pyriform sinus may be attributable to a reduced strength of the mylohyoid muscle, involved in laryngeal elevation and tongue-to-palate pressure generation (Palmer *et al*, 2008), or to a more generalized weakness of the oral cavity, pharynx, and larynx. These hypothesis should be tested with combined videofluoroscopic assessment of swallowing and may suggest potential efficacy of low-load lingual resistance training on swallow function in patients with ALS.

References

- Hiraoka A, Yoshikawa M, Nakamori M, Hosomi N, Nagasaki T, Mori T, Oda M, Maruyama H, Yoshida M, Izumi Y, Matsumoto M, Tsuga K. Maximum Tongue Pressure is Associated with Swallowing Dysfunction in ALS Patients. *Dysphagia* 2017;32:542-547.
- Weikamp JG, Schelhaas HJ, Hendriks JCM, de Swart BJM, Geurts ACH. Prognostic value of decreased tongue strength on survival time in patients with amyotrophic lateral sclerosis. *J Neurol* 2012;259:2360-5.
- Palmer PM, Jaffe DM, McCulloch TM, Finnegan EM, Van Daele DJ, Luschei ES. Quantitative contributions of the muscles of the tongue, floor-of-mouth, jaw, and velum to tongue-to-palate pressure generation. *J Speech Lang Hear Res* 2008;51:828-35.

More info

nicole.pizzorni@virgilio.it