

INTRODUCTION

There is an excess prevalence of sleep apnoea syndrome (**SAS**) in patients with spinal cord injury (**SCI**) [1]. The pathophysiological correlates of this **excess prevalence** have not been fully elucidated. The increase in pharyngeal collapsibility could be linked to various variables already identified in the general population (age, sex, BMI, macroglossia, retrognathism, etc.) but also to factors specific to SCI (reduced vital capacity, iatrogenicity, etc.) [2,3].

Recent studies have shown that nocturnal changes in fluid volumes in the lower limbs are **strongly correlated** with the apnoea-hypopnoea index (**AHI**) and time spent in the sitting position [4]. In patients with SCI, this phenomenon could be increased by two mechanisms: firstly, the **time spent sitting is obviously increased** in patients without walking autonomy (prolonged sitting in a wheelchair). Secondly, the **motor deficit leads to a loss of 'pump' activity in the skeletal muscles** of the lower limbs, which could encourage fluid to accumulate in the legs during the day [4].

To our knowledge, no study has specifically assessed the **impact of rostral fluid displacement on upper airway collapsibility in SCI patients**.

The aim of this study was to investigate a **correlation between nocturnal fluid movement and the severity of obstructive sleep apnoea hypopnoea syndrome (OSAHS) in a population of SCI patients**.

METHODS



Tape measure



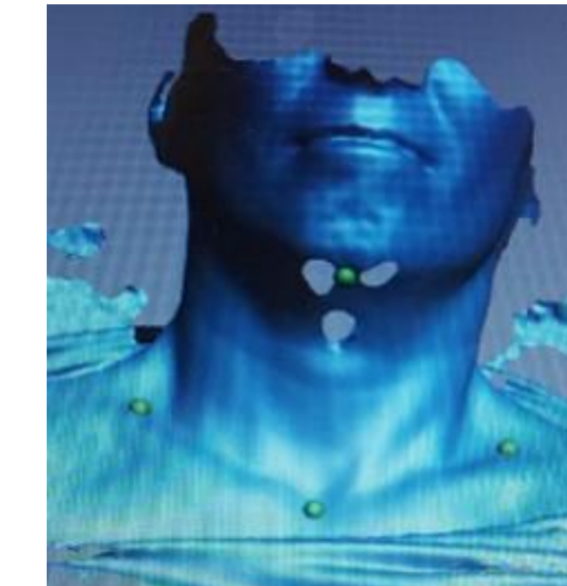
Impedancemetry



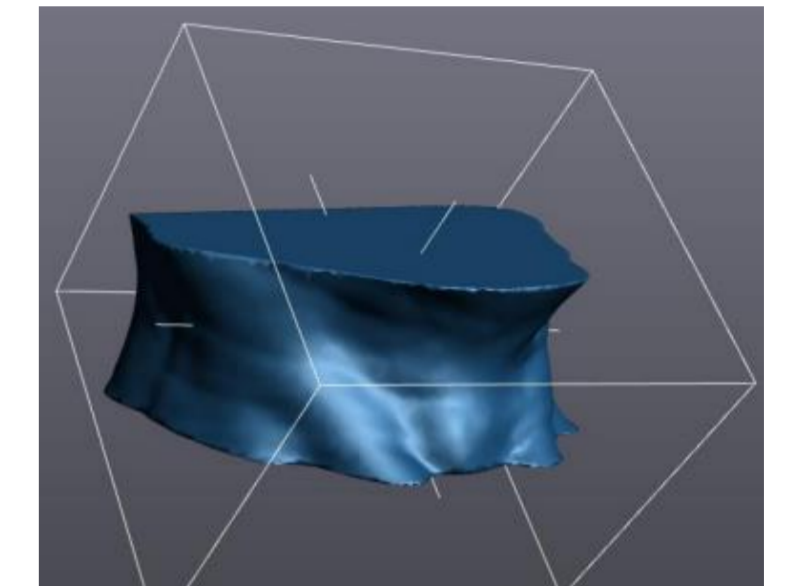
Study board



3D Scan patient positioning



3D Scan & modelling

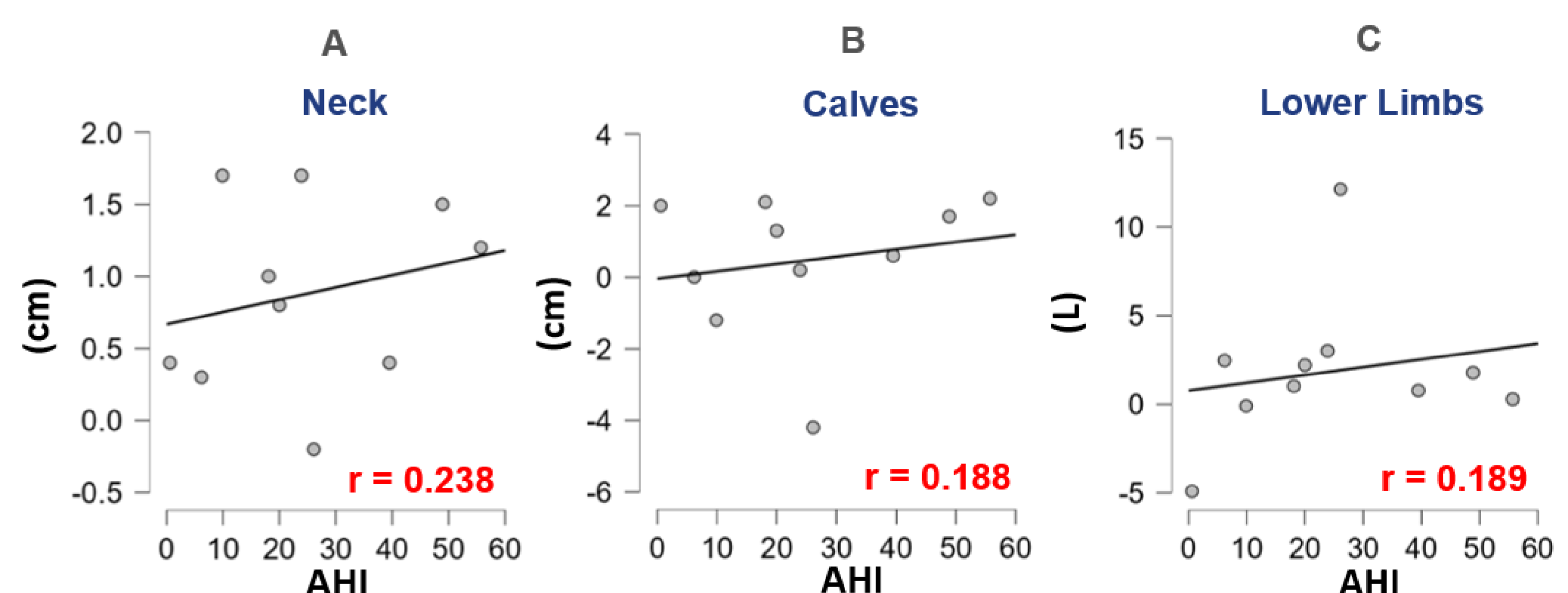


Patients with SCI were recruited from the sleep laboratory unit and the physical medicine and rehabilitation department. All patients scheduled for polysomnography with a lesion level < C6, BMI ≤ 30 Kg/m² and who were unable to walk were included between June 2022 and July 2023. A questionnaire aimed at SCI patients as well as various measurements such as AHI, tape measure circumferences (neck and calves), impedancemetry fluid displacements (lower limbs) and a 3D scan (neck) were performed the evening before lying down and the morning before getting up.

RESULTS

Baseline characteristics of SCI participants	Total n=10
Age (years)	48.2 ± 11.2
Sex, male (yes)	8 (80.0)
BMI (kg/m ²)	24.0 ± 3.4
Macroglossia (yes)	5 (50.0)
Retrognathism (yes)	0 (0.0)
AIS A (yes)	9 (90.0)
Traumatic lesion (yes)	9 (90.0)
ESS	6.9 ± 4.9
AHI (events/h)	24.9 ± 18.2
AHI ≥ 15 (yes)	7 (70.0)
AHI ≥ 30 (yes)	3 (30.0)
ODI (/h)	26.2 ± 21.2
Benzodiazepine (yes)	3 (30.0)

Data are provided as number (%) or mean ± SD as appropriate. AHI, Apnea Hypopnea Index; AIS A, American Spinal Injuries Association impairment scale A; BMI, Body Mass Index; CRF, Cardiovascular Risk Factor; ESS, Epworth Sleepiness Score; ODI, Oxygen Desaturation Index.



Graph showing the correlation coefficients (*r*) between the different variables and the AHI

Apnea Hypopnea Index (**AHI**) expressed in numbers per hour

Neck and **calves** expressed in centimeter (**cm**)

Lower Limbs expressed in Liter (**L**)

A : Correlation of the difference in neck circumference (cm) between morning and evening and the AHI (**p=0.51**)

B : Correlation of the difference in calves circumference (cm) between morning and evening and the AHI (**p=0.60**)

C : Correlation between the difference in total lower limbs volumes (L) between morning and evening and the AHI (**p=0.60**)

CONCLUSION

The movement of rostral fluids during the night have been shown to influence sleep apnea severity in non handicapped patients. This effect could be much more important in patients with SCI given reduced mobility and muscle function.

Our preliminary results (on a sample of 10 patients) show a potential influence of fluid shift with a non significant correlation between fluid accumulation and the AHI. Once recruitment is completed, with the full sample of 25 patients the power of the study will be sufficient to determine whether fluid shift is an important factor in this population.

REFERENCES

- [1] Berlowitz DJ et al. Positive airway pressure for sleep-disordered breathing in acute quadriplegia: a randomised controlled trial. *Thorax*. 2019 mars; 74(3):282-90
- [2] Jordan AS et al. Adult obstructive sleep apnoea. *Lancet*. 2014 Feb 22;383(9918):736-47
- [3] Sankari A et al. Sleep-Disordered Breathing and Spinal Cord Injury: A State-of-the-Art Review. *Chest*. Feb 2019. 155(2):438-445
- [4] Redolfi S et al. Relationship between Overnight Rostral Fluid Shift and Obstructive Sleep Apnea in Nonobese Men. *Am J Respir Crit Care Med*. 2009 Feb 1;179(3):241-6

ACKNOWLEDGEMENTS and CONFLICT OF INTEREST

With special thanks to the sleep unit nurses (Marie, Laure, Souraïa and Urszula) for their devoted care of our SCI patients.

No conflict of interest.