Autumn meeting OMFS

OPERATIVE DECISION CRITERIA FOR SLEEP APNOEA SYNDROME : RETROSPECTIVE AND PROSPECTIVE REVIEW OF 20 YEARS OF LIEGE SLEEP SURGERY (MMA).

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Coordinating supervisor: Pr. Gilon Y.

SUMMARY

01 Introduction

02 Materials and methods

03 results

04 discussion

05 Limitations and plans

06 Conclusion

01
Introduction:

- Prevalence 9 to 38% in the Occident
- 1 billion people aged between 30 and 69 worldwide
- Serious consequences: public health, costs, co-morbidity, etc.
- Increase in the incidence of the disease
- Increase in surgical options, non-invasive treatments, etc.

02
Materials and methods

Objective: To identify predictive criteria for the success of bimaxillary surgery in the treatment of OSA through the analysis of clinical and radiological data.

Inclusion:
Patients operated on by the same surgeon between 1996 and 2016 for bimaxillary surgery as part of the treatment of OSAHS.
All patients were operated on at the University Hospital of Liège, according to the same surgical protocol and by the same principal surgeon.
Maxilla-first only.

- Our sample: 88 patients.
- 15% women.
- Data on all 88 patients.
- Data on 120 PSG post-operative and 88 pre-operative

02 Materials and methods

Objective: To identify predictive criteria for the success of bimaxillary surgery in the treatment of OSA through the analysis of clinical and radiological data.

Inclusion criteria:

OSAHS confirmed by preoperative polysomnography.

Availability of pre- and postoperative records.

Patient consent to participate in the study.

Exclusion criteria:

- **Presence of another major obstructive airway condition**
- **Previous maxillofacial surgery that could affect the results**
- **Patient refusal to share the results.**

02 Materials and methods

Objective: To identify predictive criteria for the success of bimaxillary surgery in the treatment of OSA through the analysis of clinical and radiological data.

- **Clinical examination:**
- **Assessment of anthropometric parameters, weight, neck circumference, recurrences, collection of unknown data.**
- **Explanation of Somnholter®.**
- **Each patient was weighed on the same scales in the department. Each patient was measured using a height rod specifically provided for the study, and neck circumference was measured using the same tape measure.**
- **Questionnaire:**
- **HAD1 + HAD2**
- **Epworth/Esneux**
- **Horne and Ostberg sleep typology**

SF-36 quality of life

02 Materials and methods

Objective: To identify predictive criteria for the success of bimaxillary surgery in the treatment of OSA through the analysis of clinical and radiological data.

- **Imaging: Latest-generation scanner with panoramic and teleradiography export**
- **Somnholter® from Nomics and consumables from the same company. Device validated in numerous studies, superior to Brizzy® and comparable to PSG for SAHOS parameters.**
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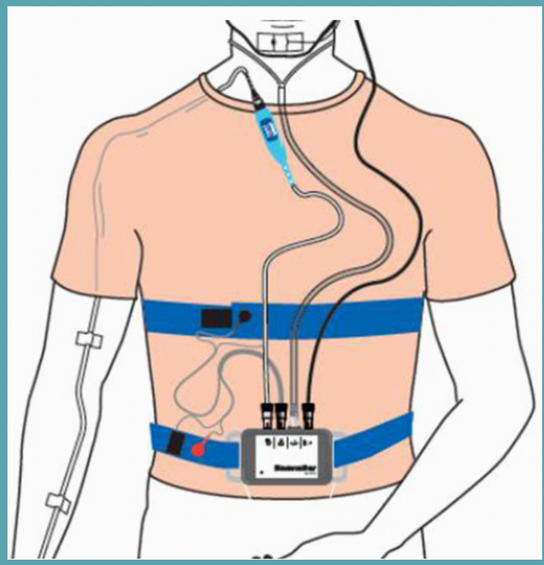


02 Materials and methods

Epworth Sleepiness Scale

How likely are you to doze off or fall asleep in the following situations?
Use the following scale to choose the most appropriate number:

0 no chance	1 slight chance	2 moderate chance	3 high chance

Sitting and reading	0 1 2 3
Watching television	0 1 2 3
Sitting inactive, in a public space	0 1 2 3
Lying down to rest in the afternoon when circumstances permit	0 1 2 3
Sitting and talking to someone	0 1 2 3
Sitting quietly after a lunch without alcohol	0 1 2 3
As a passenger in car for an hour without a break	0 1 2 3
In a car, while stopped for a few minutes in traffic	0 1 2 3

Total Score:

Echelle HAD

(1-A) Je me sens tendu(e) ou énervé(e) : 3 La plupart du temps 2 Souvent 1 De temps en temps 0 Jamais	**(8-D) J'ai l'impression de fonctionner au ralenti :** 3 Presque toujours 2 Très souvent 1 Parfois 0 Jamais
(2-D) Je prends plaisir aux mêmes choses qu'autrefois : 0 Oui, tout autant qu'avant 1 Pas autant 2 Un peu seulement 3 Presque plus	**(9-A) J'éprouve des sensations de peur et j'ai l'estomac noué :** 0 Jamais 1 Parfois 2 Assez souvent 3 Très souvent
(3-A) J'ai une sensation de peur comme si quelque chose d'horrible allait m'arriver : 3 Oui, très nettement 2 Oui, mais ce n'est pas trop grave 1 Un peu, mais cela ne m'inquiète pas 0 Pas du tout	**(10-D) Je ne m'intéresse plus à mon apparence :** 3 Plus du tout 2 Je n'y accorde pas autant d'attention que je ne devrais 1 Il se peut que je n'y fasse plus autant attention 0 J'y prête plus attention que par le passé
(4-D) Je ris et vois le bon côté des choses : 0 Autant que par le passé 1 Plus autant qu'avant 2 Vraiment moins qu'avant 3 Plus du tout	**(11-A) J'ai la bougeotte et n'arrive pas à tenir en place :** 3 Oui, c'est tout à fait le cas 2 Un peu 1 Pas tellement 0 Pas du tout
(5-A) Je me fais du souci : 3 Très souvent 2 Assez souvent 1 Occasionnellement 0 Très occasionnellement	**(12-D) Je me réjouis d'avance à l'idée de faire certaines choses:** 0 Autant qu'avant 1 Un peu moins qu'avant 2 Bien moins qu'avant 3 Presque jamais
(6-D) Je suis de bonne humeur : 3 Jamais 2 Rarement 1 Assez souvent 0 La plupart du temps	**(13-A) J'éprouve des sensations soudaines de panique :** 3 Vraiment très souvent 2 Assez souvent 1 Pas très souvent 0 Jamais
(7-A) Je peux rester tranquillement assis(e) à ne rien faire et me sentir décontracté(e) : 0 Oui, quoi qu'il arrive 1 Oui, en général 2 Rarement 3 Jamais	**(14-D) Je peux prendre plaisir à un bon livre ou à une bonne émission de télévision :** 0 Souvent 1 Parfois 2 Rarement 3 Très ramement

Score A : **Score D :** **Score total : (à remplir par le médecin)**

02 Materials and methods

Objective: To identify predictive criteria for the success of bimaxillary surgery in the treatment of OSA through the analysis of clinical and radiological data.

- **Comparison of pre- and post-operative data.**
- **Bivariate and multivariate analysis to identify predictive factors.**
- **Construction of a predictive model based on artificial intelligence and logistic regression.**
- **Ethics committee for validation and informed consent for each patient.**

03
Results.

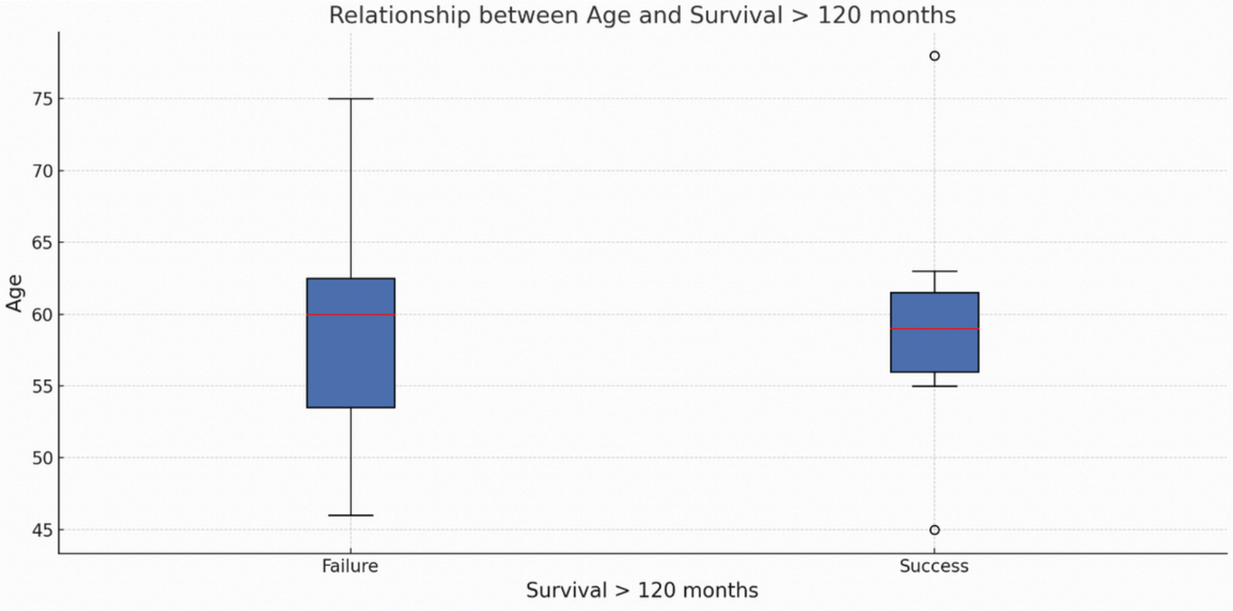
a. **Success:** IAH ≤ 15 or less than half the starting value.
b. **Partial success:** IAH between 15 and 30.
c. **Failure:** IAH > 30.

Descriptive statistics:

The average age of participants is 59.9 years (standard deviation: 8.9), indicating a relatively elderly population, with an average of 15.2 years post-surgery (standard deviation: 5.0).

The average weight of patients is 86.6 kg (standard deviation: 16.5), while the average height is 177.5 cm (standard deviation: 8.6).
These data indicate a population with a body mass index (BMI) that could be considered slightly above normal.

03 Results.



Bivariate analysis:

N = 88

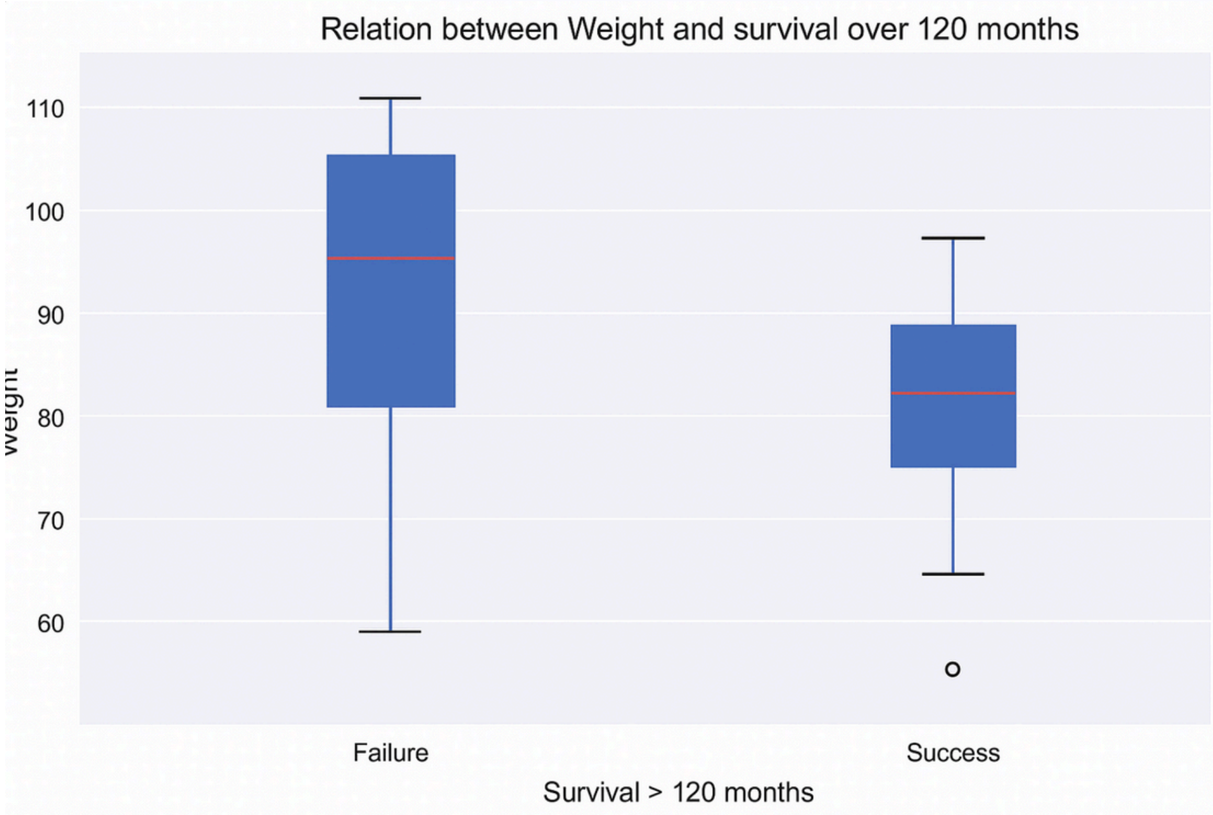
Age vs. surgical success

The association between age and long-term surgical success We note that the median age in the successful group is much lower than in the relapse group (58.5 years vs. 62 years). This difference appears significant according to the graph.

We obtain a p-value of 0.87, or 87%. This value is higher than the chosen threshold of 5%. We therefore conclude that the two variables are statistically independent.

There is no association between these two variables, and the difference in age between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 88

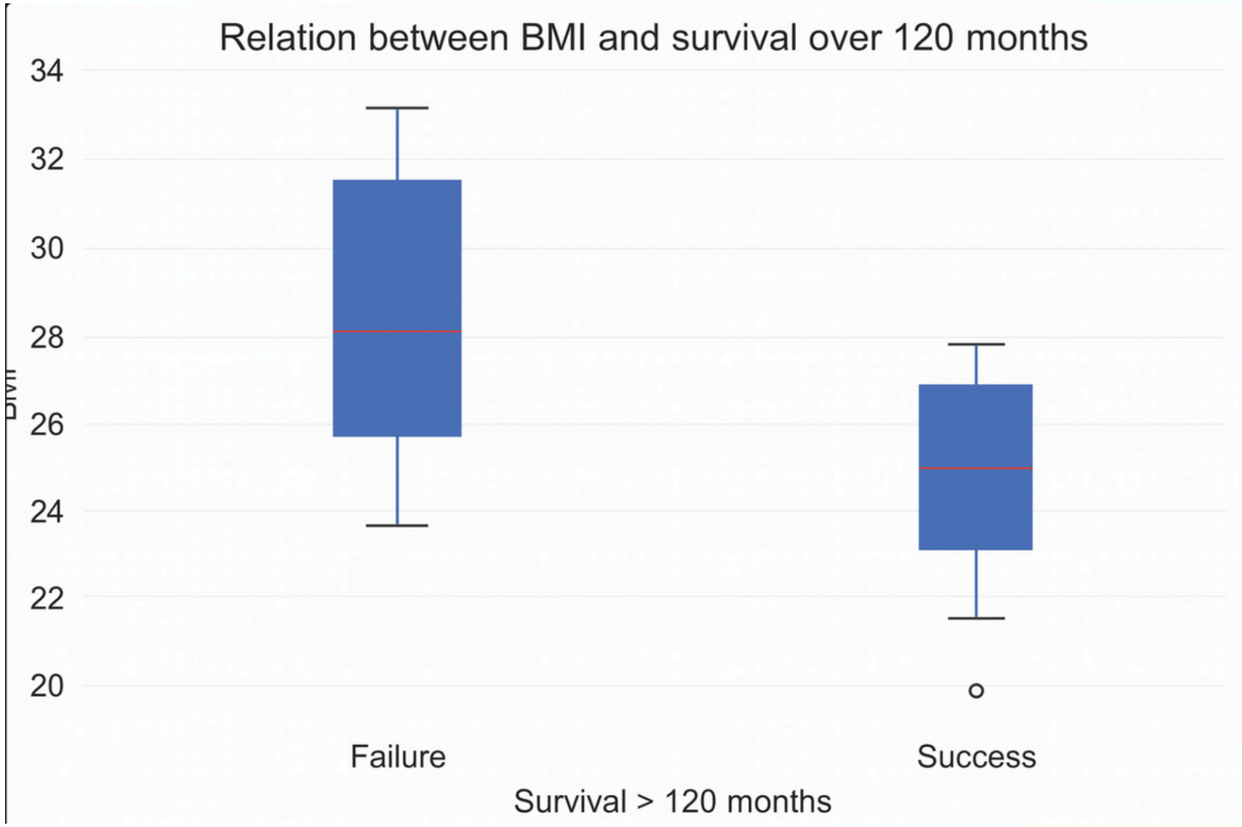
Weight vs. surgical success

The association between weight and long-term surgical success We note that the median weight in the successful group is much lower than in the relapse group (80 kg vs. 101 kg). This difference appears significant according to the graph.

We obtain a p-value of 0.009, which is less than 1%. This value is below the chosen threshold of 5%.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The lower the weight, the more likely the operation will be successful in the long term.

03 Results.



Bivariate analysis:

N = 88

BMI vs. surgical success

The association between BMI and long-term surgical success. We observe that the median in the success group is significantly lower than in the relapse group (24.9 vs. 28.1). This difference appears significant according to the graph.

We obtain a p-value of 0.02, or 2%. This value is below the chosen threshold of 5%.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The lower the BMI, the more likely the operation will be successful in the long term.

03 Results.

Bivariate analysis:

N = 88

Height vs. surgical success

The association between height and long-term surgical success. We observe that the median height in the successful group is significantly lower than in the relapse group (172.5 cm vs. 181.5 cm). This difference appears significant according to the graph.

Significant difference between the two variables.
We obtain a p-value of 0.18, or 18%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent. There is no association between these two variables. Height does not influence long-term surgical success.

03 Results.

Bivariate analysis:

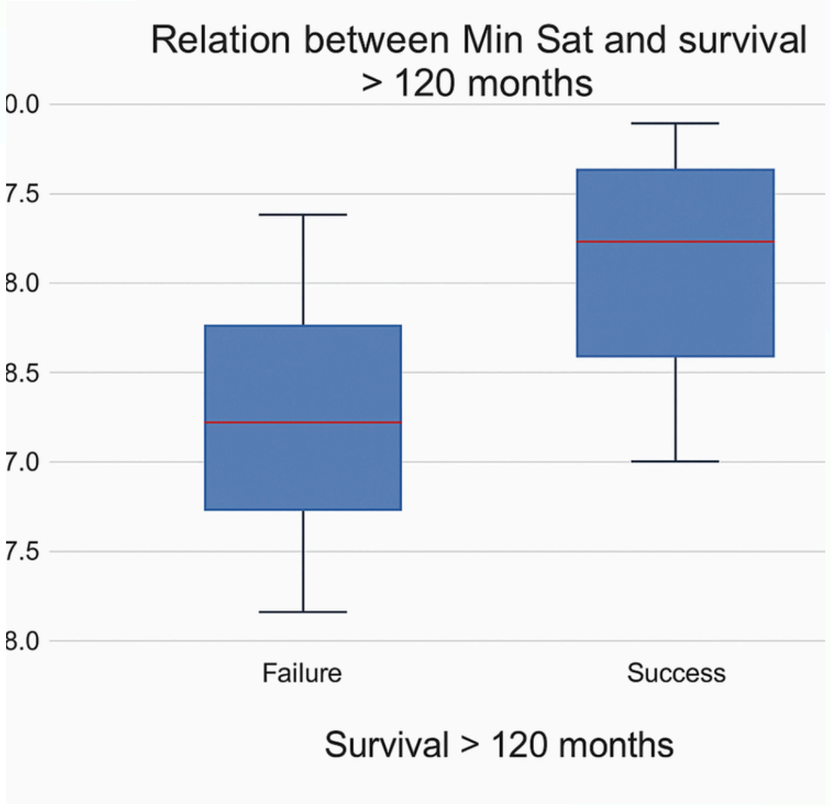
N = 88

IDO vs. surgical success

The association between IDO and long-term surgical success. We note that the median in the success group is much lower than in the relapse group (5.75 vs. 26.90). This difference appears significant according to the graph.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The lower the IDO, the more likely the operation will be successful in the long term.

03 Results.



Bivariate analysis:

Min sat% vs. operation success

N= 88

The association between minimum saturation and long-term operation success. We note that the median in the success group is much higher than in the relapse group (86.5 vs. 79.5). This difference appears significant according to the graph.

We obtain a p-value of 0.004, which is less than 1%. This value is below the chosen threshold of 5%.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The higher the minimum saturation, the more likely the operation will be successful in the long term.

This is the variable with very high statistical power, which will play a key role in the predictive algorithm.

03 Results.

Bivariate analysis:

N = 88

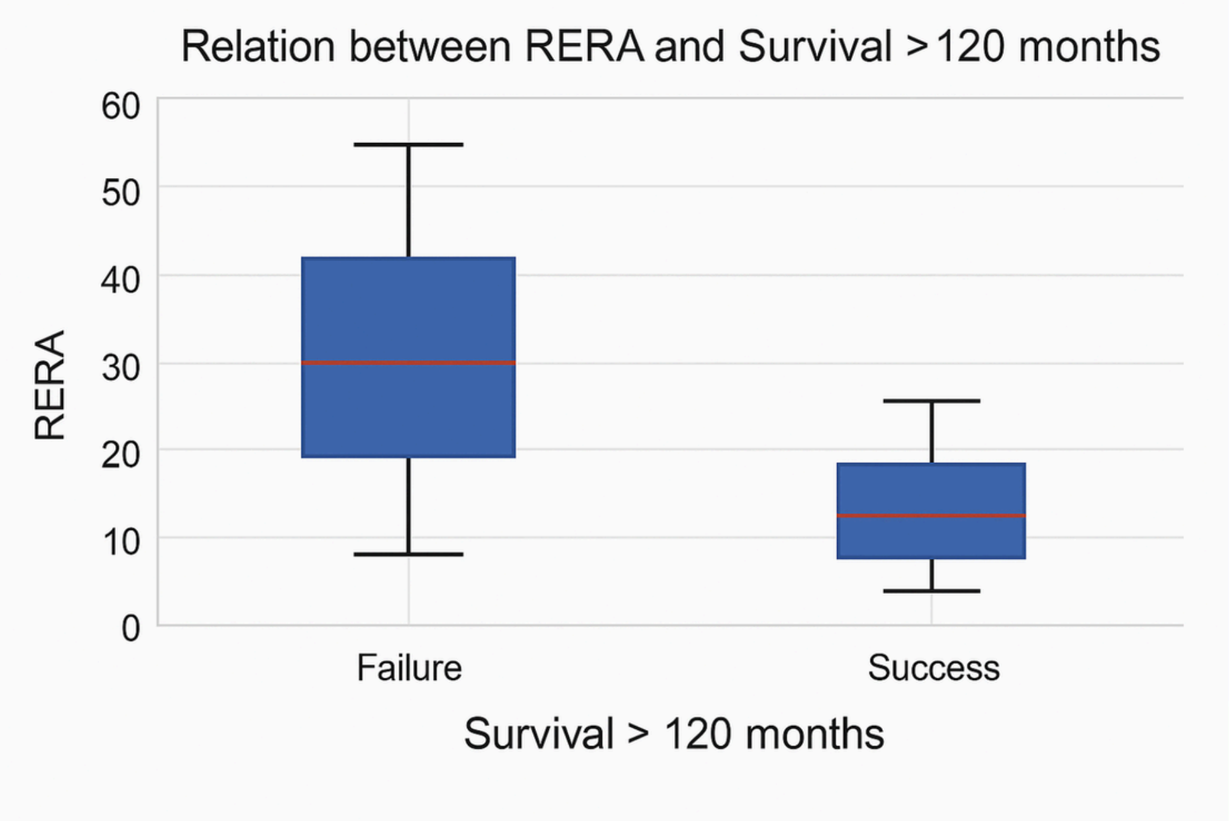
RDi-Tst vs. operational success

The association between RDI-TST and long-term operational success. We note that the median in the success group is much lower than in the relapse group (10.70 vs. 26.55). This difference appears significant according to the graph.

We obtain a p-value of 0.01, or 1%. This value is below the chosen threshold of 5%.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The lower the RDI-TST, the more likely the operation will be successful in the long term.

03 Results.



Bivariate analysis:

N = 88

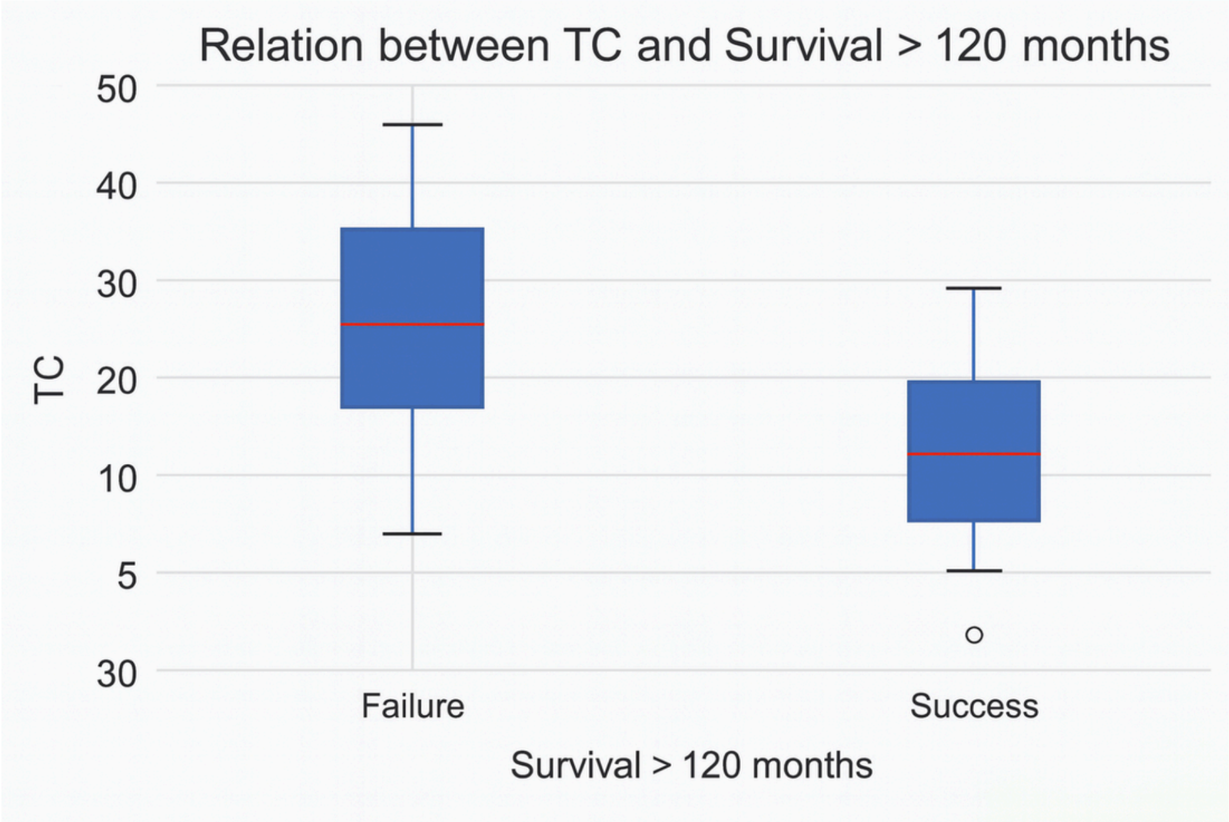
RERA vs. surgical success

The association between RERA and long-term surgical success. We observe that the median in the success group is much lower than in the relapse group (13.4 vs. 35.1). This difference appears significant according to the graph.

We obtain a p-value of less than 0.001, i.e. less than 1%. This value is below the chosen threshold of 5%.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The lower the RERA, the more likely the operation will be successful in the long term.

03 Results.



Bivariate analysis:

N = 88

TC vs. surgical success

The association between TC and long-term surgical success. We note that the median in the success group is much lower than in the relapse group (40.5 vs. 44.5). This difference appears significant according to the graph.

We obtain a p-value of less than 0.04, or 4%. This value is below the chosen threshold of 5%.

We therefore conclude that the two variables are statistically dependent. There is an association between these two variables. The lower the TC, the more likely the operation will be successful in the long term.

03 Results.

Bivariate analysis:

N = 88

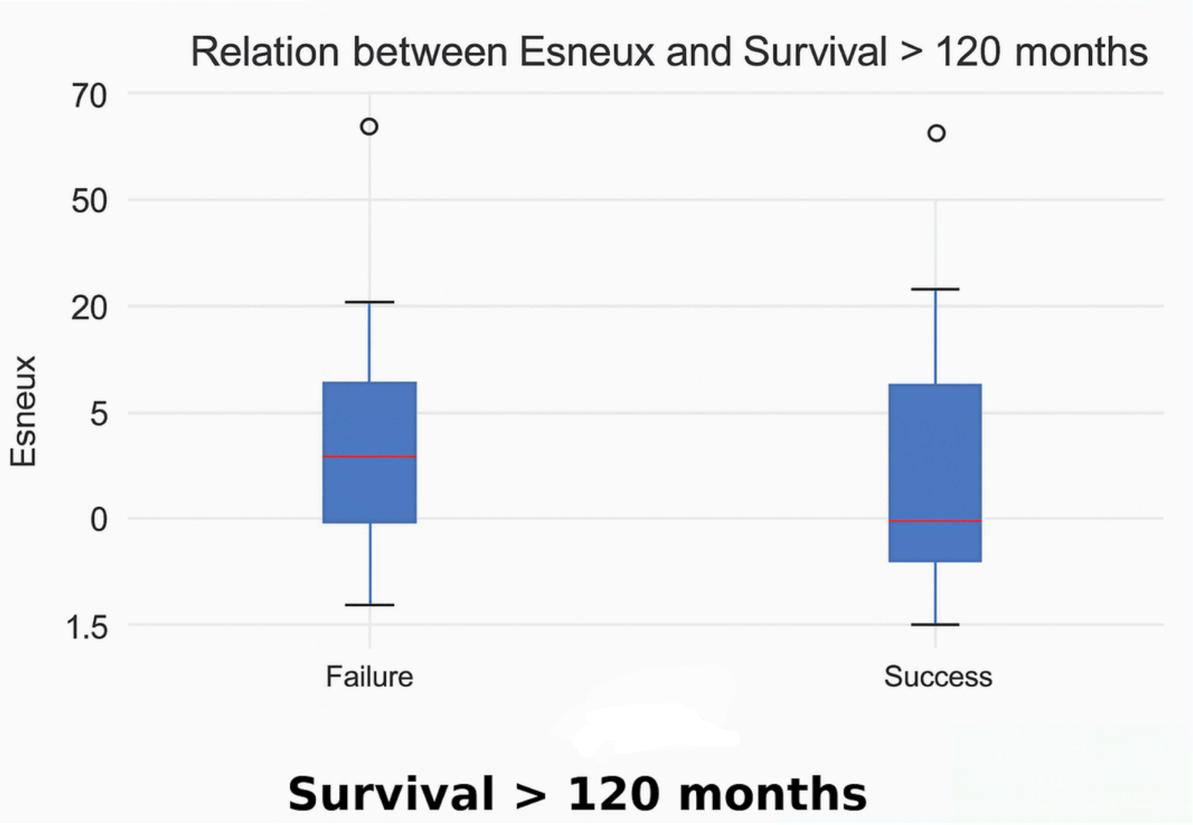
Epworth vs. surgical success

The association between Epworth and long-term surgical success. We note that the median in the success group is much lower than in the relapse group (6 vs. 8). This difference appears significant according to the graph.

We obtain a p-value of 0.77, or 77%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables and the difference observed between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 27

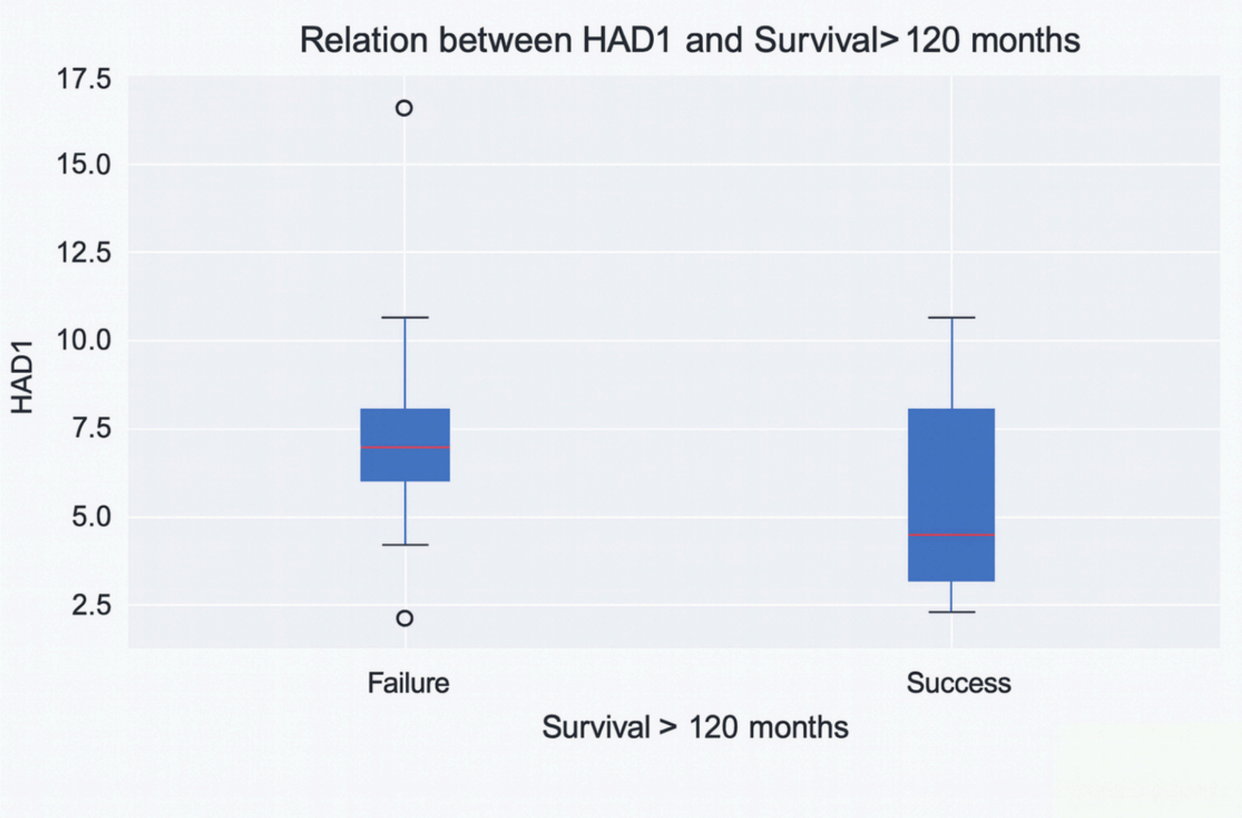
Esneux vs. treatment success

The graph below shows the association between Esneux and long-term treatment success. We can see that the medians between the two groups (success and relapse) are similar (3 vs. 4). This difference does not appear to be significant according to the graph.

We obtain a p-value of 0.80, or 80%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables, and the difference observed between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 28

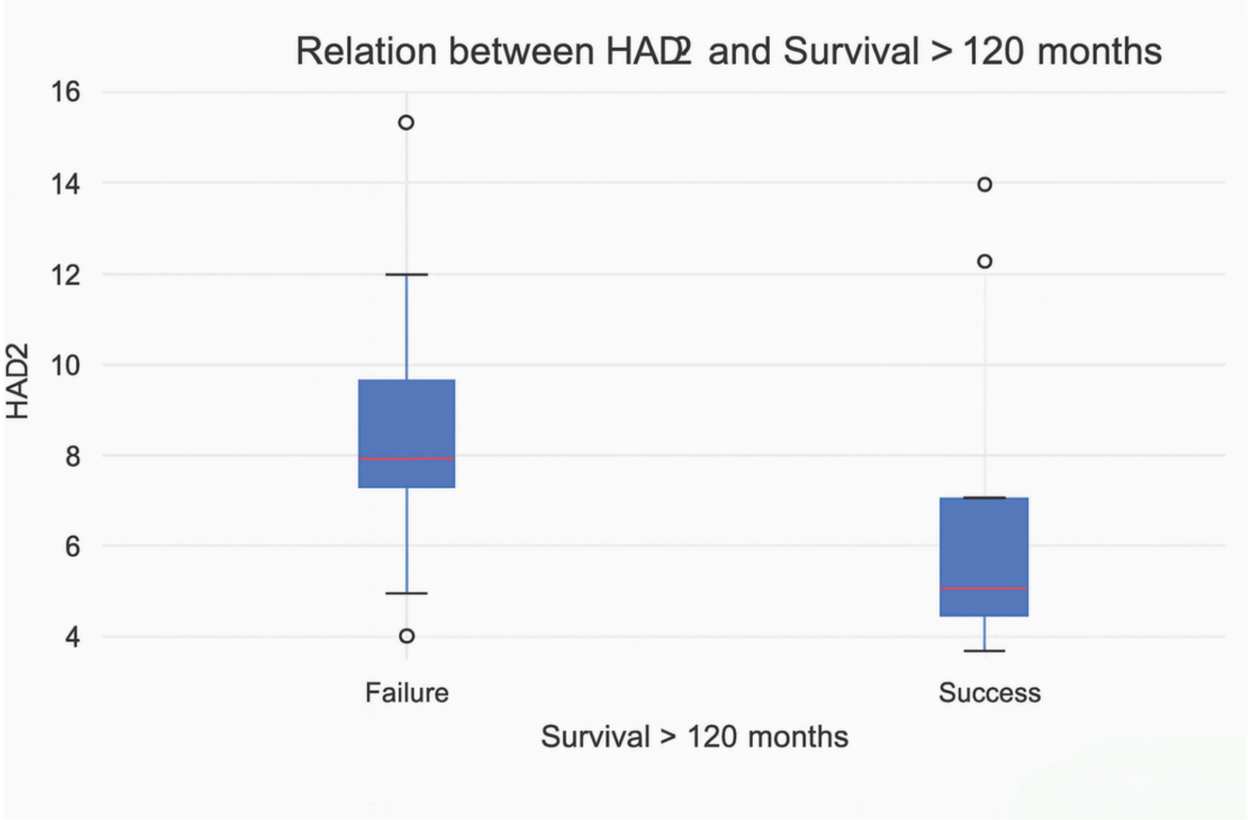
HAD1 vs. surgical success

The association between HAD1 and long-term surgical success (i.e., after 120 months). We observe that the medians between the two groups (success and relapse) are different. The median for the success group is lower. This difference appears to be significant according to the graph.

We obtain a p-value of 0.26, or 26%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables and the difference observed between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 28

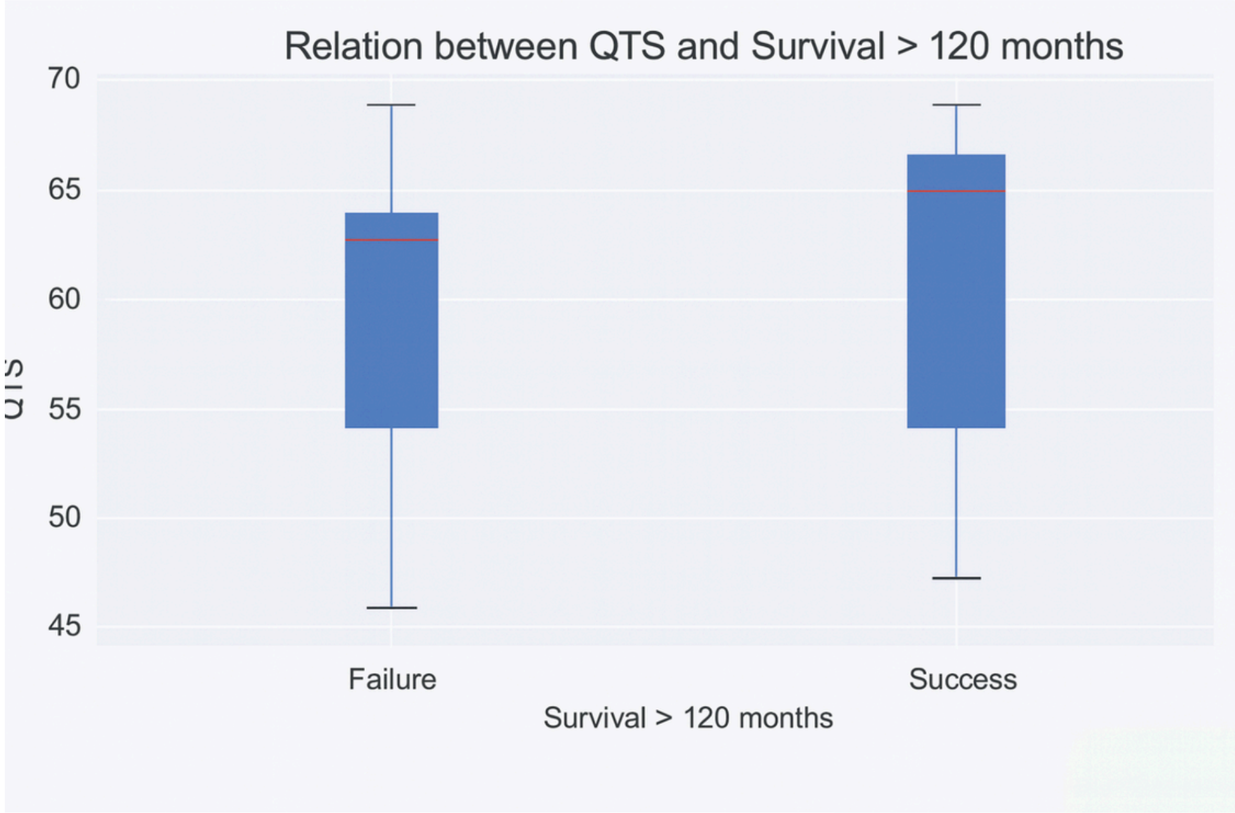
HAD2 vs. surgical success

The association between HAD2 and long-term surgical success (i.e., after 120 months). We observe that the medians between the two groups (success and relapse) are different. The median for the success group is lower. This difference appears to be significant according to the graph.

We obtain a p-value of 0.06, or 6%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables, and the difference observed between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 28

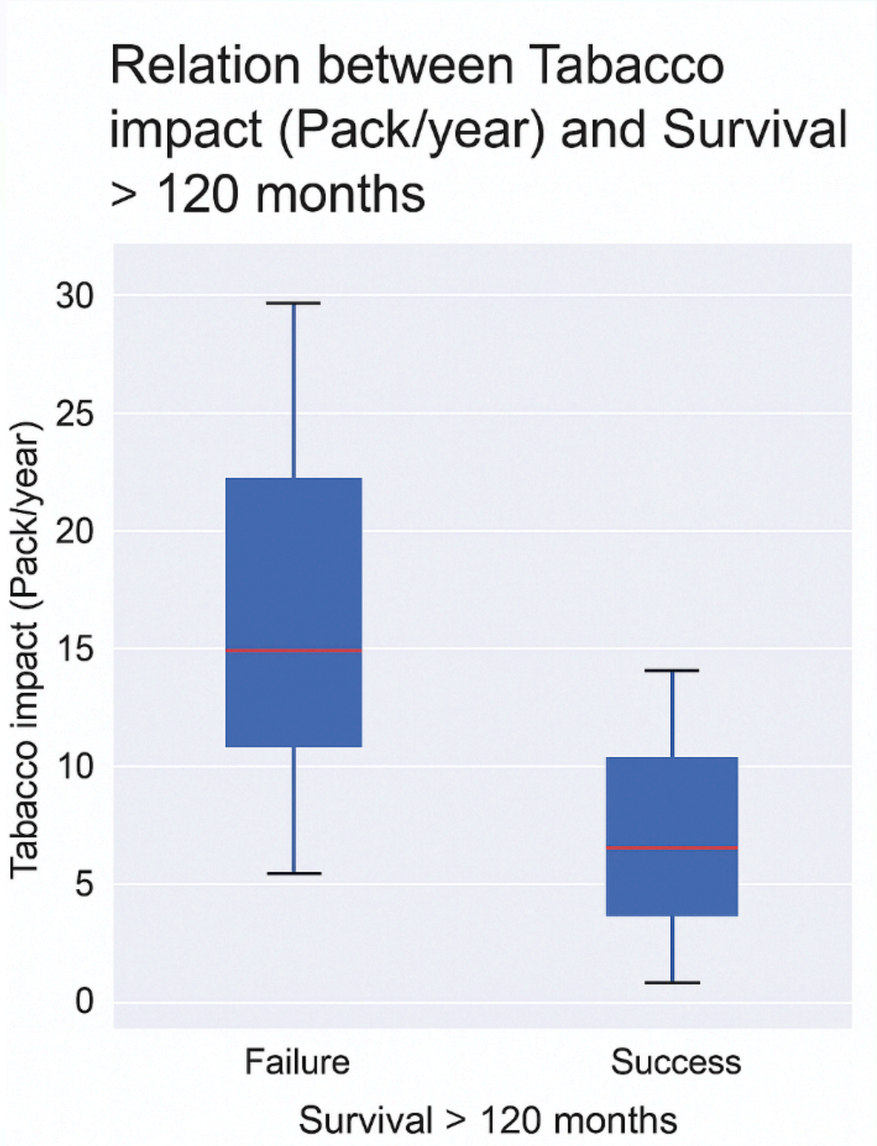
QTS vs. surgical success

The association between QTS and long-term surgical success . We find that the medians between the two groups (success and relapse) are similar, suggesting that there are no significant differences between the two groups in terms of QTS.

We obtain a p-value of 0.62, or 62%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables, and the difference observed between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 88

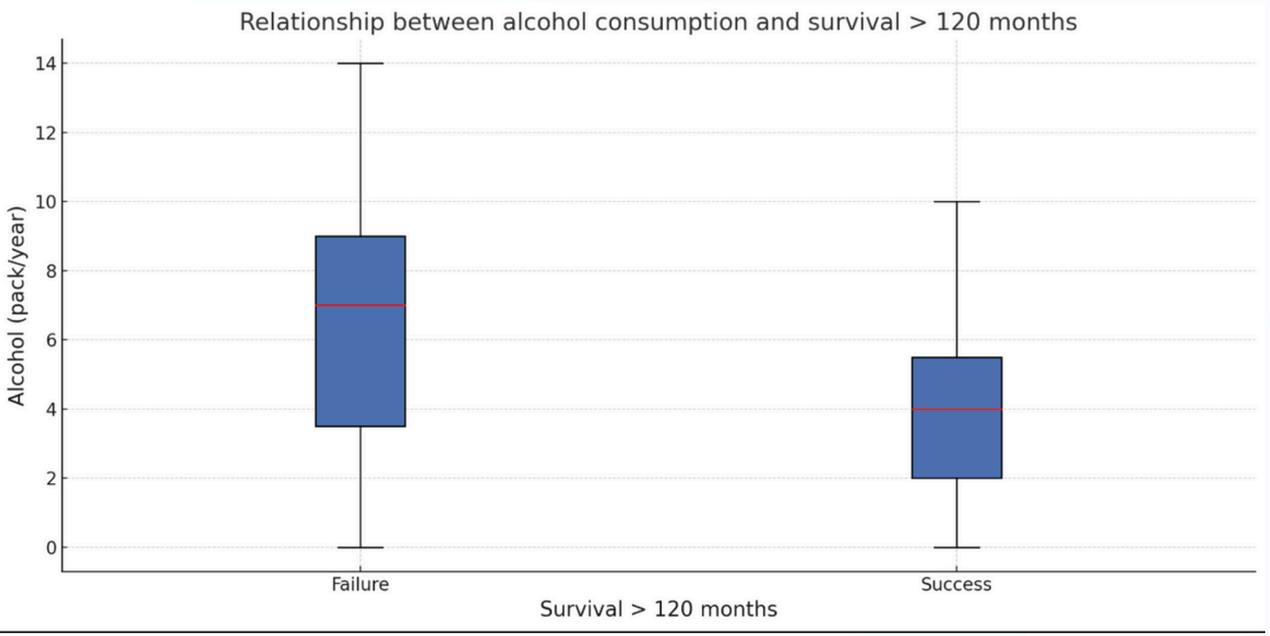
smoking vs. surgical success

The association between smoking and long-term surgical success (i.e. after 120 months). We observe that the medians between the two groups (success and relapse) are different. The median for the success group is lower (less tobacco consumed). This difference appears to be significant according to the graph.

We obtain a p-value of 0.17, or 17%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables and the difference observed between the two groups is due to chance.

03 Results.



Bivariate analysis:

N = 88

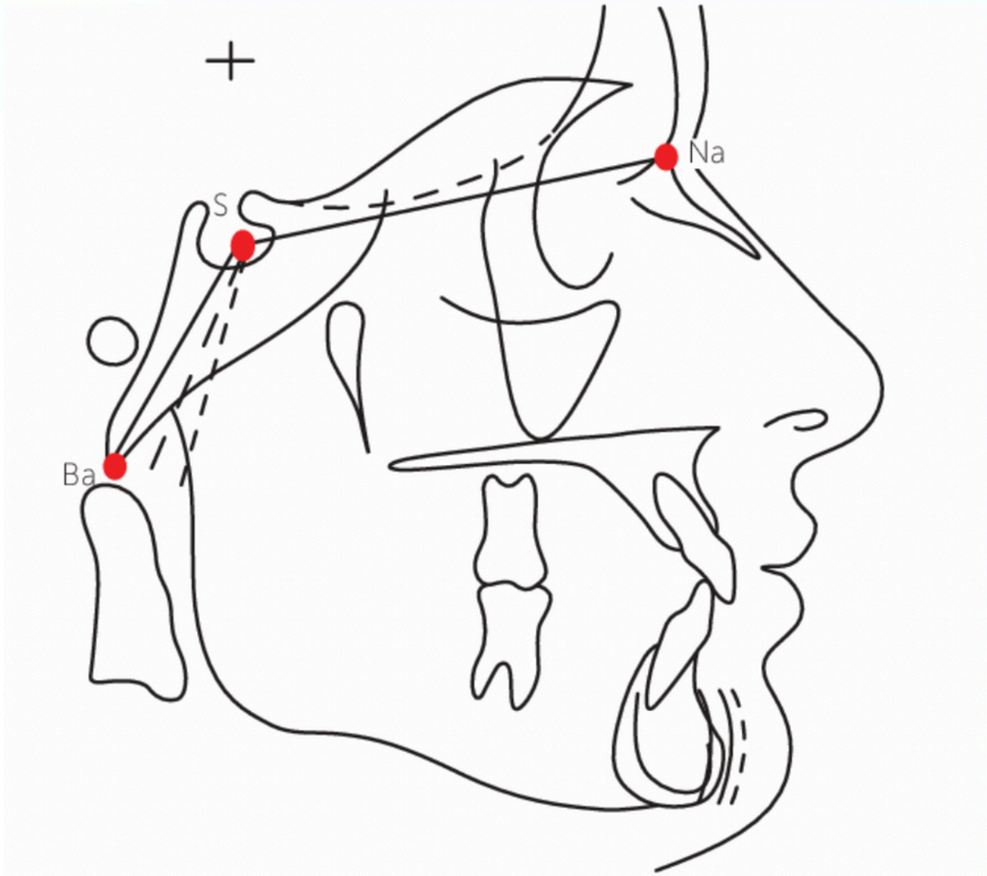
Alcohol vs. treatment success

The association between alcohol consumption and long-term treatment success (i.e. after 120 months). We observe that the medians between the two groups (success and relapse) are different. The median for the success group is lower. This difference appears to be significant according to the graph.

We obtain a p-value of 0.24, or 24%. This value is higher than the chosen threshold of 5%.

We therefore conclude that the two variables are statistically independent.
There is no association between these two variables, and the difference observed between the two groups is due to chance.

03
Results.



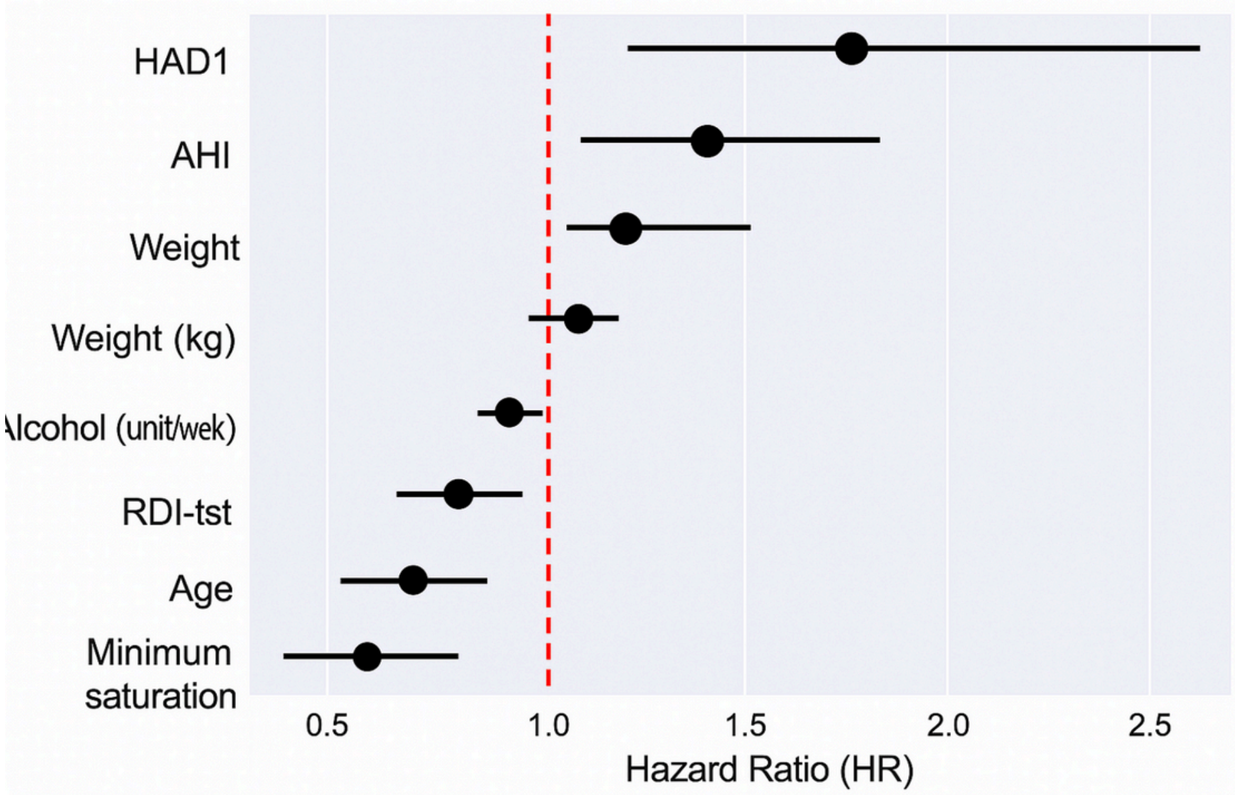
Bivariate analysis:

- **Ba-S-N (nl 140°)**
- **SNA (nl 82°)**
- **SNB (nl 80°)**
- **Ba-N (nl 113mm)**
- **S-N (nl 71-78mm)**

Only Ba-S-N is statistically significant!!

03 Results.

Hazard Ratios following the cox model with 95% confidence index



Multivariate :

Cox model retaining only the most significant variables:

Height
Age
HAD1
Alcohol (u/week)

Independant variables

Min sat
Weight (kg)
RDI-TST
IAH
Ba-S-N

Dependant variables

Lower Hazard Ratio
Higher Hazard Ration

Multivariate analysis relies on a set of dependent and independent variables which together enable the construction of a powerful and stable predictive algorithm.

04 Discussion

HAD1 (HR = 1.79; 95% CI [1.23-2.61]; p < 0.01): a higher HAD1 score is associated with a significant increase in the risk of long-term failure. In other words, the higher the anxiety/depression score, the lower the probability of post-operative success.

IAH (HR = 1.46; 95% CI [1.12-1.91]; p = 0.01): greater severity of sleep apnoea syndrome (high IAH) also increases the risk of treatment failure.

Height (HR = 1.29; 95% CI [1.07–1.56]; p = 0.01) and weight (HR = 1.11; 95% CI [1.01–1.21]; p = 0.03): taller stature and heavier weight appear to be predictive factors for a poorer prognosis. These morphological parameters therefore seem to play an unfavourable role in the success of the operation.

The variables HAD1, IAH, Ba-s-n (> 140°) and Weight have an HR greater than 1, indicating that they are associated with an increased risk (lower probability of long-term success). Conversely, Alcohol, RDI-TST, Age and Min sat have an HR lower than 1, indicating a protective effect associated with a better probability of postoperative success.
Among these, Min sat (HR = 0.57, p < 0.01) and HAD1 (HR = 1.79, p < 0.01) appear to be the factors most strongly associated with patient outcomes.

04 Discussion

- Alcohol (u/week) (HR = 0.92; 95% CI [0.86-0.97]; p = 0.01): alcohol consumption is associated with an HR below 1, paradoxically suggesting a protective effect. However, this result should be interpreted with caution, as it could reflect selection bias or confounding related to patient profiles.
-
-
- RDI-TST (HR = 0.80; 95% CI [0.67-0.96]; p = 0.02): a higher RDI-TST index is associated with a decrease in risk, indicating an unexpected protective effect, which warrants further exploration in additional analyses.

Age (HR = 0.69; 95% CI [0.51–0.92]; p = 0.01): surprisingly, older age is associated with a higher probability of long-term success. This could be explained by better post-operative follow-up or better treatment compliance in older patients.

Min sat (HR = 0.57; 95% CI [0.40–0.81]; p < 0.01): higher minimum saturation appears to be a major protective factor, reflecting better respiratory reserve and a better response to surgical treatment.

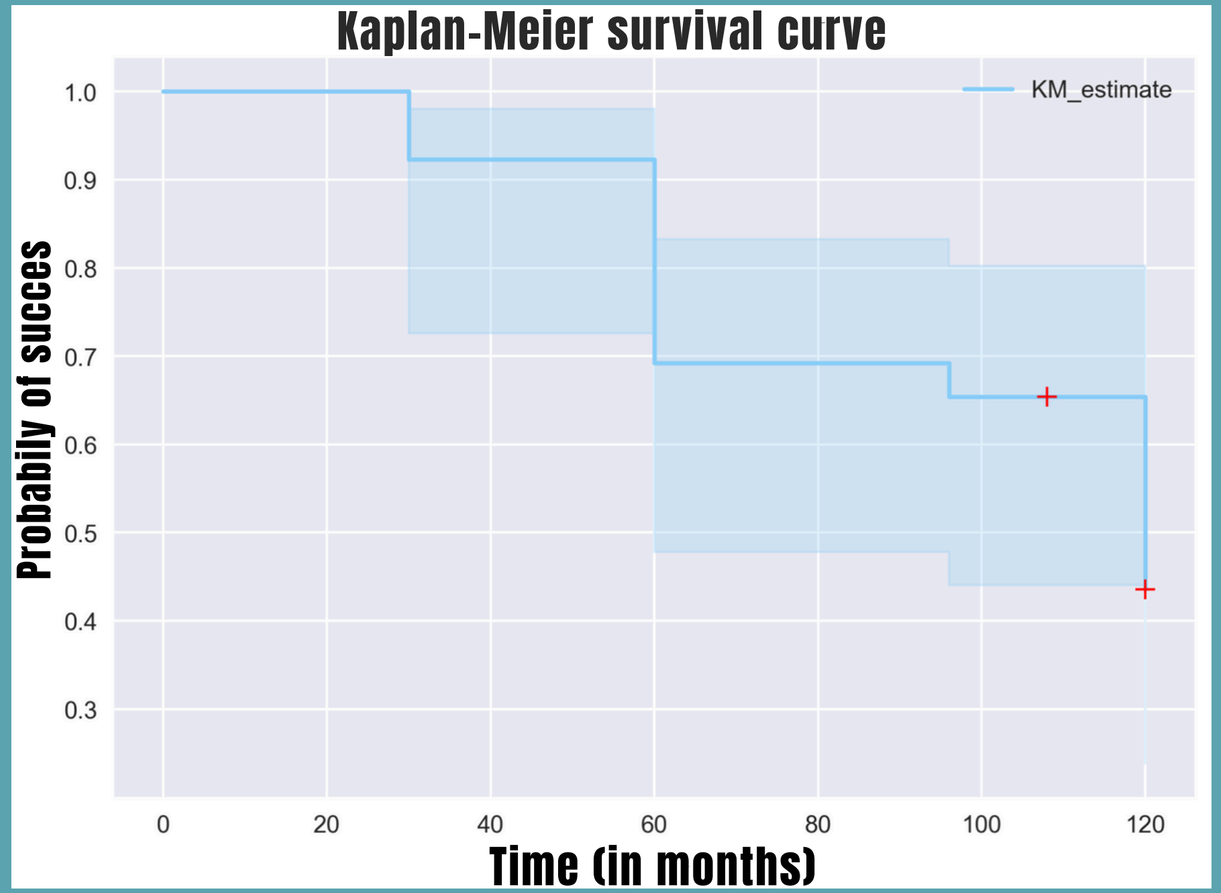
- Ba-s-n > 140° (HR = 1.63; 95% CI [1.17–2.26]; p < 0.001): a wider craniofacial angle is significantly associated with a lower probability of success, suggesting the importance of morphological parameters in postoperative success.

04 Discussion

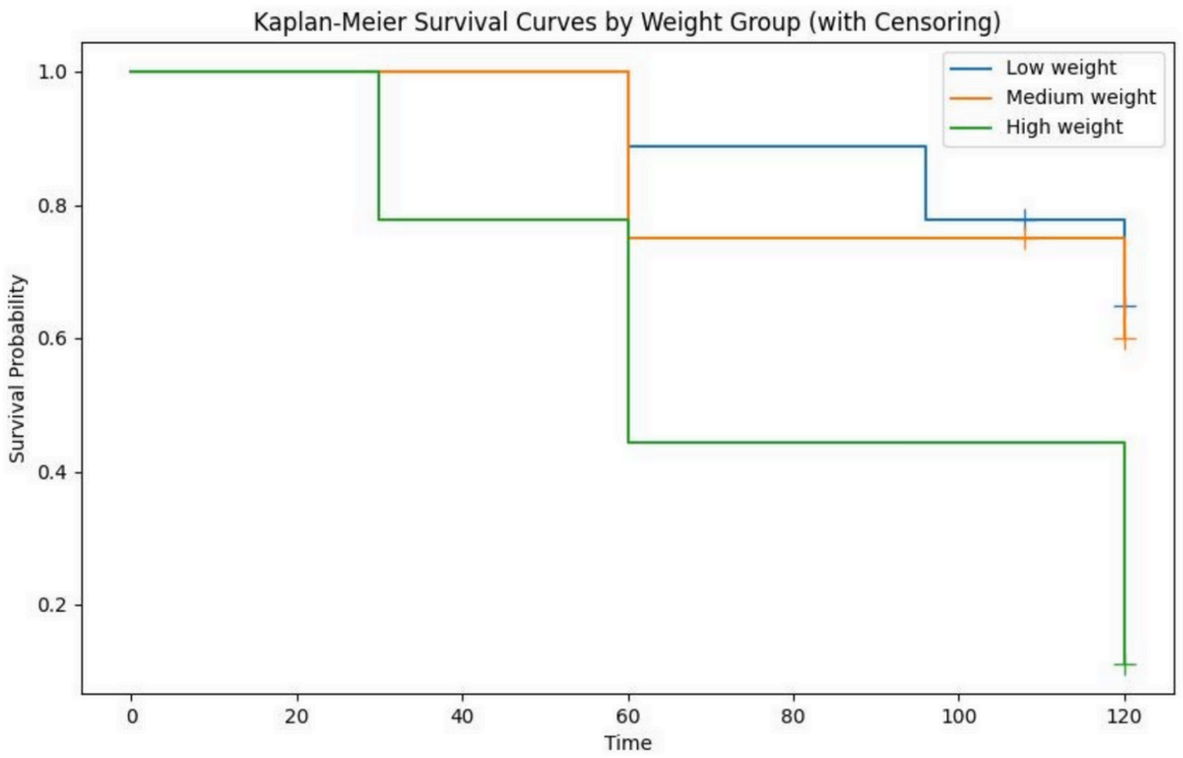
The survival curve using the Kaplan Meier model. It provides an idea of the probability of success according to the targeted post-operative period.

N = 88
PSG = 120

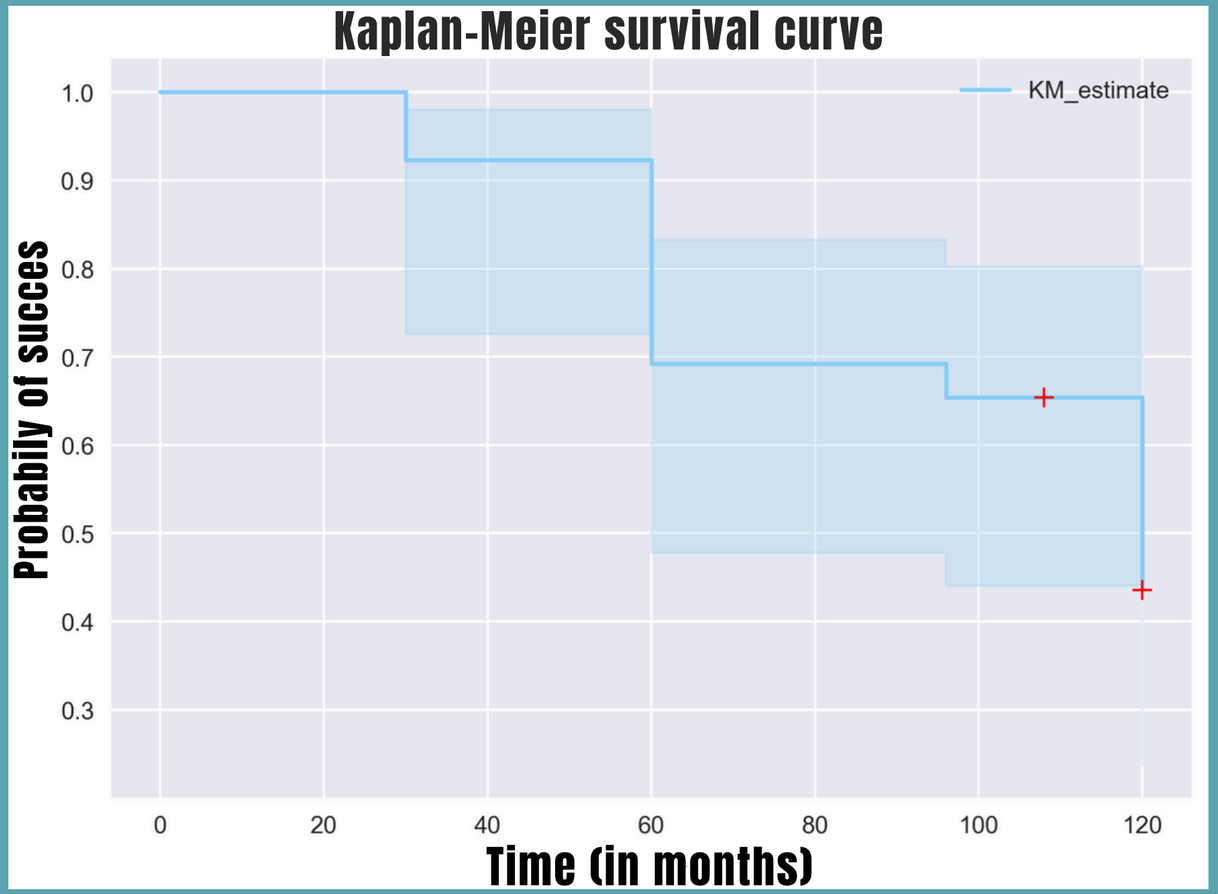
The result '>120 months' combines all results greater than 10 years up to 20 years into a single group.
This means that the predictive value is lower than if time T were exactly 120 months.
The algorithm is therefore also 'pessimistic' for predictions after 120 months.



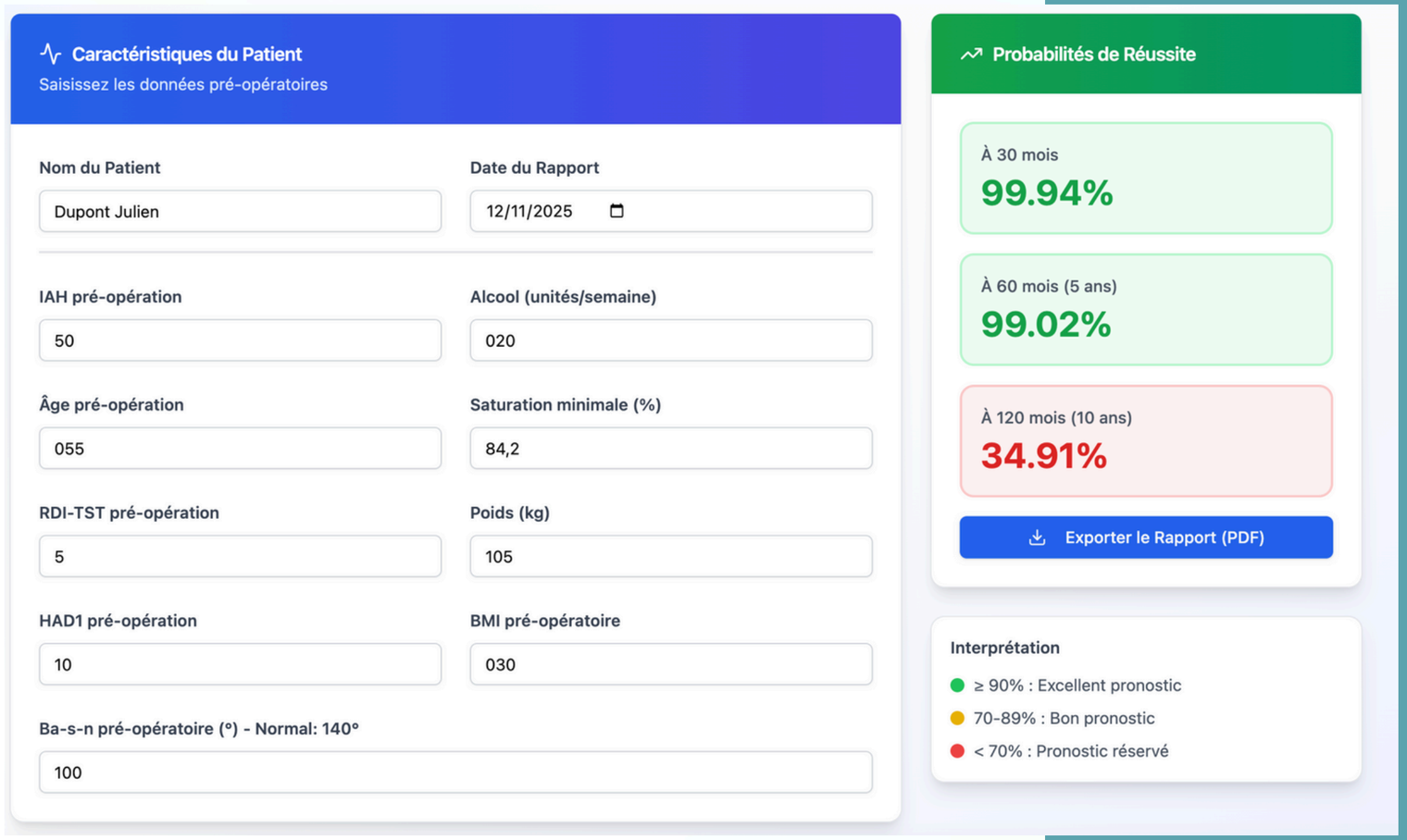
04 Discussion

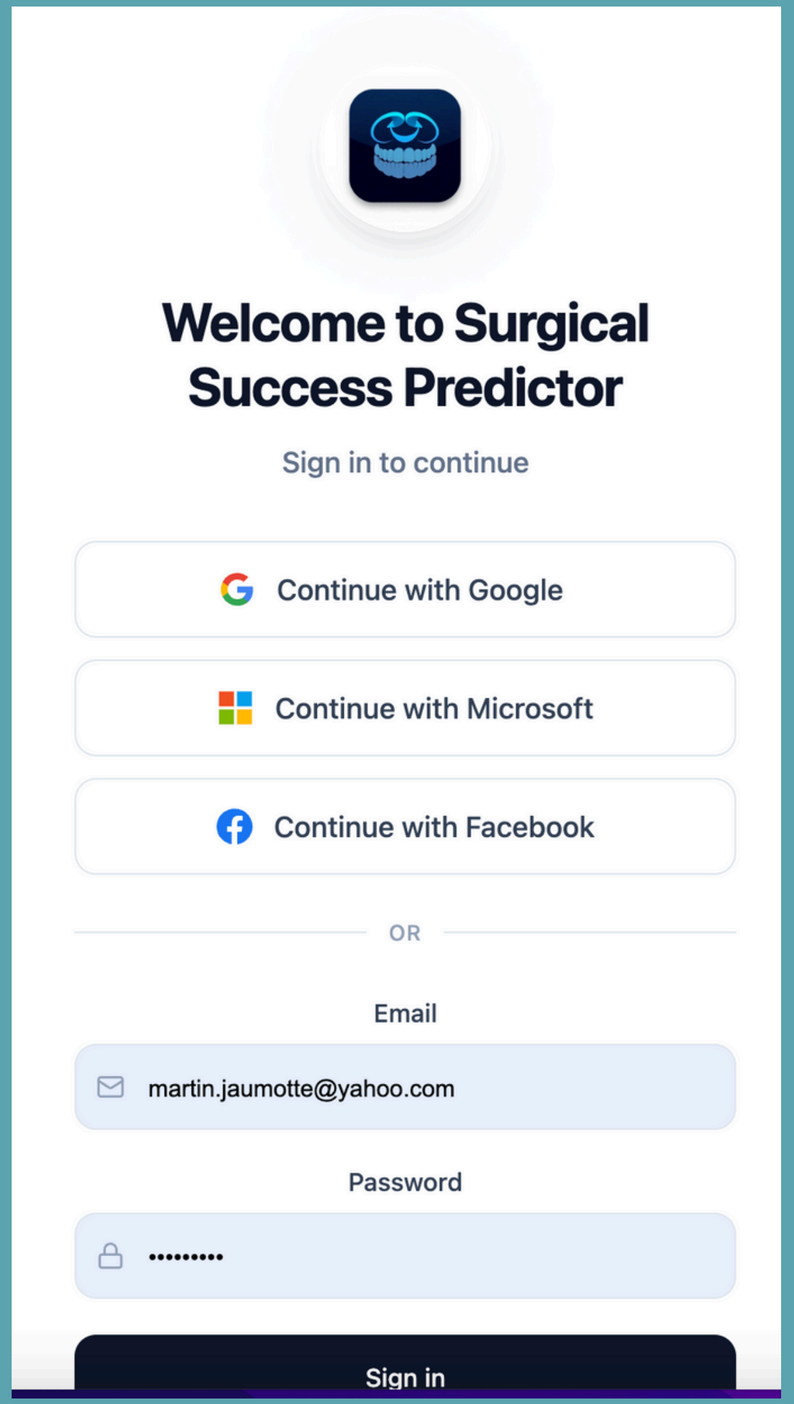


Low weight = BMI 20- 25
Medium BMI = BMI 25 - 30
High Weight = BMI >30



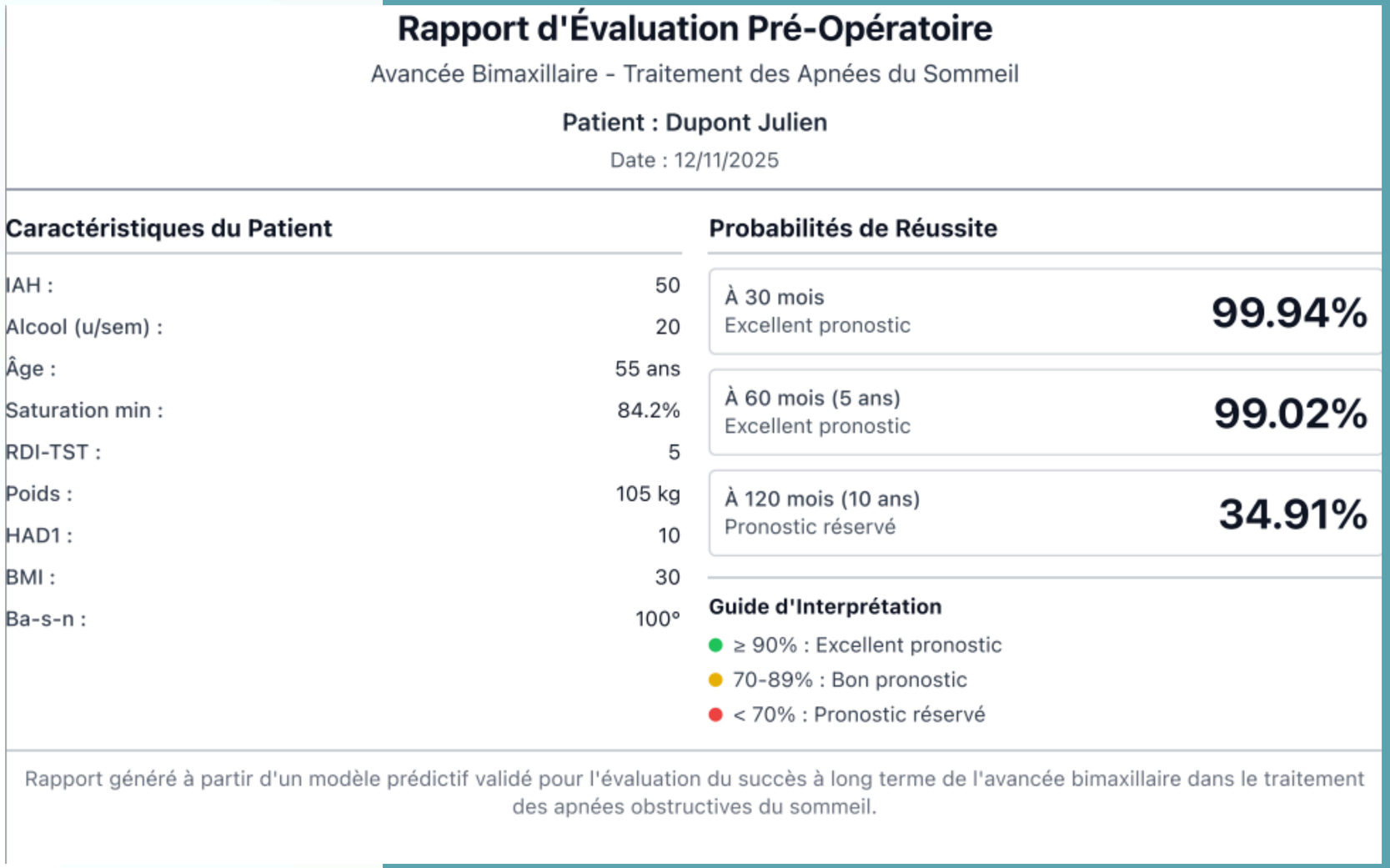
04 Discussion





04 Discussion

This application is currently only available in French.



Rapport d'Évaluation Pré-Opératoire

Avancée Bimaxillaire - Traitement des Apnées du Sommeil

Patient : Dupont Julien

Date : 12/11/2025

Caractéristiques du Patient

IAH :	50
Alcool (u/sem) :	20
Âge :	55 ans
Saturation min :	84.2%
RDI-TST :	5
Poids :	105 kg
HAD1 :	10
BMI :	30
Ba-s-n :	100°

Probabilités de Réussite

À 30 mois Excellent pronostic	99.94%
À 60 mois (5 ans) Excellent pronostic	99.02%
À 120 mois (10 ans) Pronostic réservé	34.91%

Guide d'Interprétation

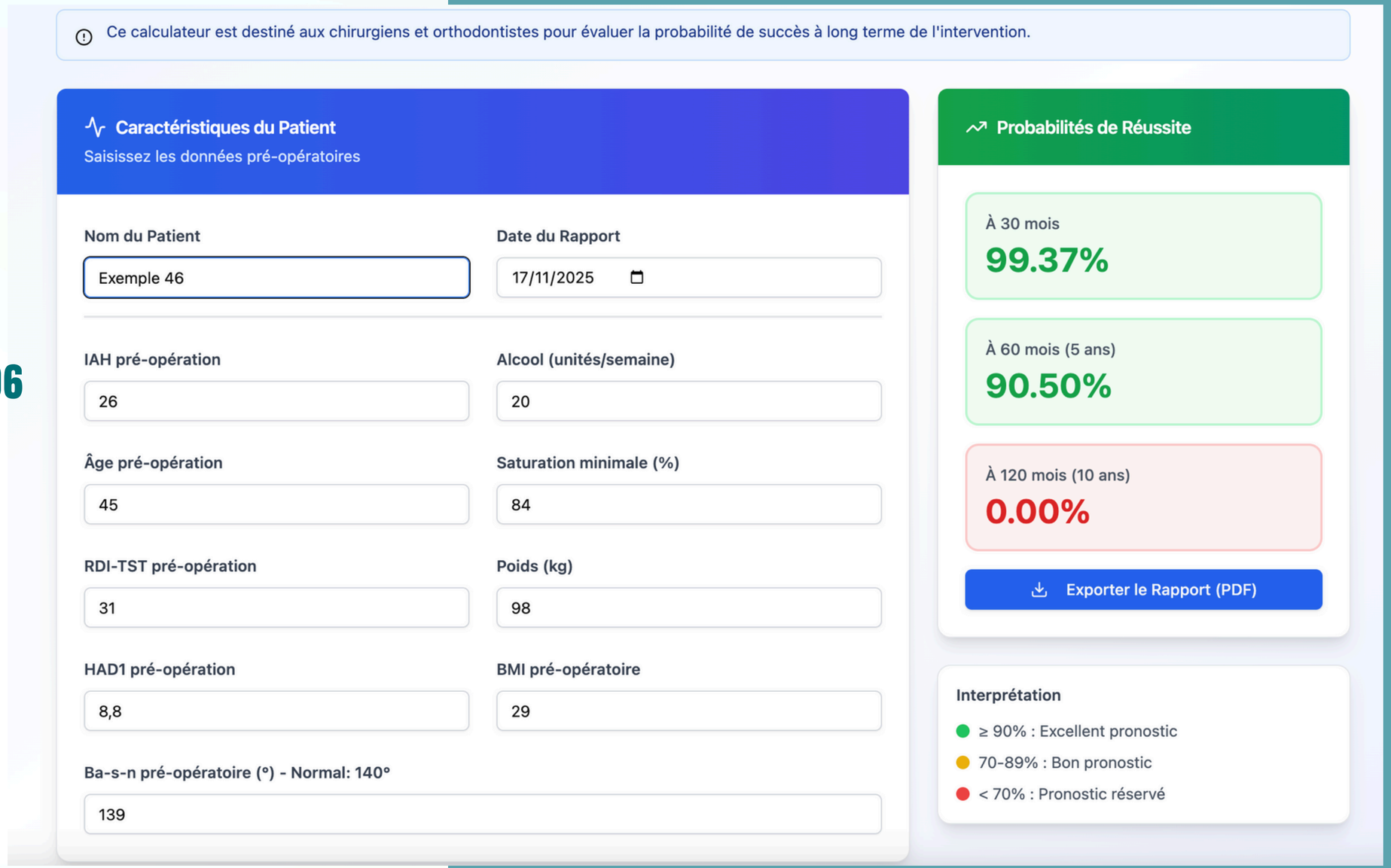
- ≥ 90% : Excellent pronostic
- 70-89% : Bon pronostic
- < 70% : Pronostic réservé

Rapport généré à partir d'un modèle prédictif validé pour l'évaluation du succès à long terme de l'avancée bimaxillaire dans le traitement des apnées obstructives du sommeil.

04 Discussion

Real clinical data

Patient 46
Intervention date : 13/03/2006
Evaluation : 1 - 5 - 13 years
IAH T0 : 26,10
IAH T1 : 10,3
IAH T3 : 11,9
IAH T 13 : 58,2



04
Limitations ans plans

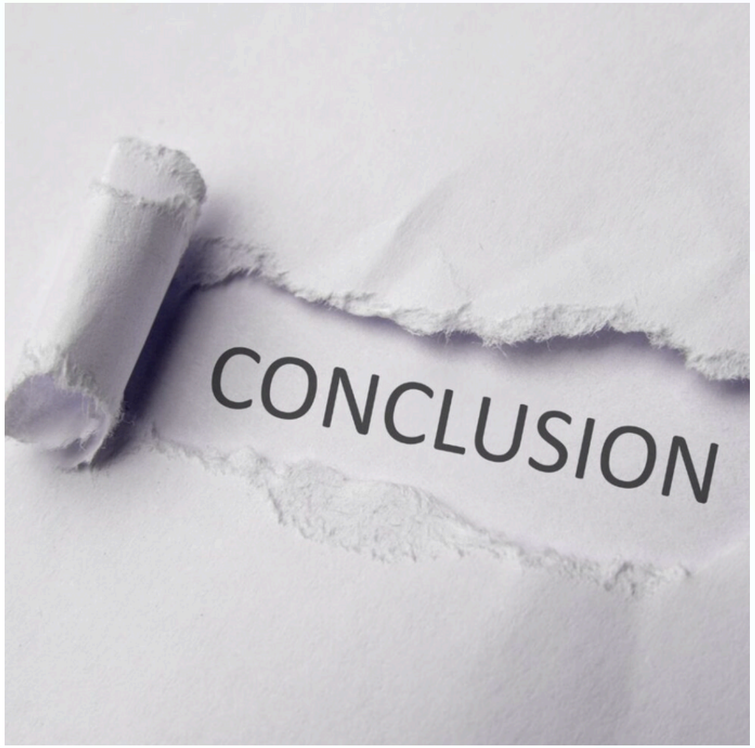
The main limitations of this study concern:

The analysis of a single surgical technique. It would be interesting to explore other bimaxillary advancement techniques.

There are no immediate post-operative cephalometric measurements.

Looking ahead:
- decision-making algorithm for other types of surgical and non-surgical interventions
- ability to implement these surgical cases in the application
- focus on volumetric cephalometric measurements in the long term.

05
Conclusion



A rich history of surgery in Liège has given rise to a predictive algorithm that is easy for anyone to use.

Well-established criteria for correlation with the long-term success of the procedure.

Identified limitations and a clear future.

An application that will be made available free of charge once my thesis has been defended.