



**HAL**  
open science

# Impact de la pression motrice sur la mortalité chez les patients obèses et non obèses en SDRA : une étude de cohorte rétrospective

Jeanne Cossic

► **To cite this version:**

Jeanne Cossic. Impact de la pression motrice sur la mortalité chez les patients obèses et non obèses en SDRA : une étude de cohorte rétrospective. Médecine humaine et pathologie. 2018. dumas-02959202

**HAL Id: dumas-02959202**

**<https://dumas.ccsd.cnrs.fr/dumas-02959202>**

Submitted on 6 Oct 2020

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons Attribution - NonCommercial - ShareAlike 4.0 International License

UNIVERSITE DES ANTILLES

2018

FACULTE DE MEDECINE  
HYACINTHE BASTARAUD

N°

**Impact de la pression motrice sur la mortalité chez  
les patients obèses et non obèses en SDRA : une  
étude de cohorte rétrospective**

**THESE**

Présentée et soutenue publiquement à la Faculté de Médecine de Montpellier  
Et examinée par les Enseignants de la dite Faculté et de la Faculté de Médecine Hyacinthe  
BASTARAUD des Antilles

Le 19 janvier 2018

Pour obtenir le grade de

**DOCTEUR EN MEDECINE**

Par

**Jeanne COSSIC**

Née le 16/01/1989 à VANNES (56)  
D.E.S Anesthésie Réanimation

Examineurs de la thèse : Mr JABER Samir

Mr CARLES Michel  
Mr CHANQUES Gérald  
Mme DE JONG Audrey

Professeur,  
Président du jury  
Professeur  
Professeur  
Docteur Médecine  
Directeur de thèse

UNIVERSITE DES ANTILLES

2018

FACULTE DE MEDECINE  
HYACINTHE BASTARAUD

N°

**Impact de la pression motrice sur la mortalité chez  
les patients obèses et non obèses en SDRA : une  
étude de cohorte rétrospective**

**THESE**

Présentée et soutenue publiquement à la Faculté de Médecine de Montpellier  
Et examinée par les Enseignants de la dite Faculté et de la Faculté de Médecine Hyacinthe  
BASTARAUD des Antilles

Le 19 janvier 2018

Pour obtenir le grade de

**DOCTEUR EN MEDECINE**

Par

**Jeanne COSSIC**

Née le 16/01/1989 à VANNES (56)

D.E.S Anesthésie Réanimation

Examineurs de la thèse : Mr JABER Samir

Mr CARLES Michel  
Mr CHANQUES Gérald  
Mme DE JONG Audrey

Professeur,  
Président du jury  
Professeur  
Professeur  
Docteur Médecine  
Directeur de thèse

**Le Président de l'Université des Antilles : Eustase JANKY**  
**Doyen de la Faculté de Médecine : Raymond CESAIRE**  
**Vice-Doyen de la Faculté de Médecine : Suzy DUFLO**

| Professeurs des Universités - Praticiens Hospitaliers  |  |
|--|--|
| <b>Bruno HOEN</b><br><a href="mailto:bruno.hoen@chu-guadeloupe.fr">bruno.hoen@chu-guadeloupe.fr</a>                                      | <b>Maladies Infectieuses</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tel : 05 90 89 15 45                 |
| <b>Pascal BLANCHET</b><br><a href="mailto:pascal.blanchet@chu-guadeloupe.fr">pascal.blanchet@chu-guadeloupe.fr</a>                       | <b>Chirurgie Urologique</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tel : 05 90 89 13 95                  |
| <b>André-Pierre UZEL</b><br><a href="mailto:maxuzel@hotmail.com">maxuzel@hotmail.com</a>   | <b>Chirurgie Orthopédique et Traumatologie</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel : 05 90 89 14 66 |
| <b>Pierre COUPPIE</b><br><a href="mailto:pierre.couppie@ch-cayenne.fr">pierre.couppie@ch-cayenne.fr</a>                                  | <b>Dermatologie</b><br>CH de CAYENNE<br>Tel : 05 94 39 53 39   |
| <b>Thierry DAVID</b><br><a href="mailto:pr.t.david@chu-guadeloupe.fr">pr.t.david@chu-guadeloupe.fr</a>                                   | <b>Ophtalmologie</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel : 05 90 89 14 55                           |
| <b>Suzy DUFLO</b><br><a href="mailto:suzy.duflo@chu-guadeloupe.fr">suzy.duflo@chu-guadeloupe.fr</a>                                      | <b>ORL – Chirurgie Cervico-Faciale</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel : 05 90 93 46 16         |
| <b>Eustase JANKY</b><br><a href="mailto:eustase.janky@univ-antilles.fr">eustase.janky@univ-antilles.fr</a>                               | <b>Gynécologie-Obstétrique</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel 05 90 89 13 89                   |
| <b>François ROQUES</b><br><a href="mailto:chirurgie.cardiaque@chu-fortdefrance.fr">chirurgie.cardiaque@chu-fortdefrance.fr</a>           | <b>Chirurgie Thoracique et Cardiovasculaire</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 22 71    |
| <b>Jean ROUDIE</b><br><a href="mailto:jean.roudie@chu-fortdefrance.fr">jean.roudie@chu-fortdefrance.fr</a>                               | <b>Chirurgie Digestive</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 21 01 - Tel : 05 96 55 22 71  |
| <b>Jean-Louis ROUVILLAIN</b><br><a href="mailto:jean-louis.rouvillain@chu-fortdefrance.fr">jean-louis.rouvillain@chu-fortdefrance.fr</a> | <b>Chirurgie Orthopédique</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 22 28                      |
| <b>André CABIE</b><br><a href="mailto:andre.cabie@chu-fortdefrance.fr">andre.cabie@chu-fortdefrance.fr</a>                               | <b>Maladies Infectieuses</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 23 01                       |
| <b>Philippe CABRE</b><br><a href="mailto:pcabre@chu-fortdefrance.fr">pcabre@chu-fortdefrance.fr</a>                                      | <b>Neurologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 22 61                                  |
| <b>Vincent MOLINIE</b><br><a href="mailto:vincent.molinie@chu-chu-fortdefrance.fr">vincent.molinie@chu-chu-fortdefrance.fr</a>           | <b>Anatomopathologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 23 50                           |

Professeurs des Universités - Praticiens Hospitaliers  
(Suite)

|  |   |
|--|---|
| <b>Raymond CESAIRE</b><br><a href="mailto:raymond.cesaire@chu-fortdefrance.fr">raymond.cesaire@chu-fortdefrance.fr</a>                   | <b>Bactériologie-Virologie-Hygiène option virologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 24 11 |
| <b>Maryvonne DUEYMES-BODENES</b><br><a href="mailto:maryvonne.dyeymes@chu-fortdefrance.fr">maryvonne.dyeymes@chu-fortdefrance.fr</a>     | <b>Immunologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 24 24                                      |
| <b>Régis DUVAUFERRIER</b><br><a href="mailto:regis.duvaufferier@chu-fortdefrance.fr">regis.duvaufferier@chu-fortdefrance.fr</a>          | <b>Radiologie et imagerie Médicale</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 21 84                  |
| <b>Annie LANNUZEL</b><br><a href="mailto:annie.lannuzel@chu-guadeloupe.fr">annie.lannuzel@chu-guadeloupe.fr</a>                          | <b>Neurologie</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tel : 05 90 89 14 13                                 |
| <b>Louis JEHEL</b><br><a href="mailto:louis.jehel.@chu-fortdefrance.fr">louis.jehel.@chu-fortdefrance.fr</a>                             | <b>Psychiatrie Adulte</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 20 44                               |
| <b>Mathieu NACHER</b><br><a href="mailto:mathieu.nacher@ch-cayenne.fr">mathieu.nacher@ch-cayenne.fr</a>                                  | <b>Epidémiologie, Economie de la Santé et Prévention</b><br>CH de CAYENNE<br>Tel : 05 94 93 50 24           |
| <b>Guillaume THIERY (en disponibilité)</b><br><a href="mailto:guillaume.thiery@chu-guadeloupe.fr">guillaume.thiery@chu-guadeloupe.fr</a> | <b>Réanimation</b><br>CHU de POINTE-A-PITRE/BYMES<br>Tel : 05 90 89 17 74                                   |
| <b>Magalie DEMAR - PIERRE</b><br><a href="mailto:magalie.demar@ch-cayenne.fr">magalie.demar@ch-cayenne.fr</a>                            | <b>Parasitologie et Infectiologie</b><br>CH de CAYENNE<br>Tel : 05 94 39 53 09                              |
| <b>Vincent MOLINIE</b><br><a href="mailto:vincent.molinie@chu-fortdefrance.fr">vincent.molinie@chu-fortdefrance.fr</a>                   | <b>Anatomie Cytologie Pathologique</b><br>CHU de FORT DE FRANCE<br>Tel : 05 96 55 20 85/55 23 50            |
| <b>Philippe KADHEL</b><br><a href="mailto:philippe.kadhel@chu-guadeloupe.fr">philippe.kadhel@chu-guadeloupe.fr</a>                       | <b>Gynécologie-Obstétrique</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel : 05 90 89 13 20                      |
| <b>Michel DEBANDT</b><br><a href="mailto:micheldebandt@gmail.com">micheldebandt@gmail.com</a>  | <b>Rhumatologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 23 52                                     |
| <b>Jeannie HELENE-PELAGE</b><br><a href="mailto:jeannie.pelage@wanadoo.fr">jeannie.pelage@wanadoo.fr</a>                                 | <b>Médecine Générale</b><br>CHU de Pointe-à-Pitre / Cabinet libéral<br>Tel : 05 90 84 44 40                 |
| <b>Karim FARID</b><br><a href="mailto:kwfarid@hotmail.com">kwfarid@hotmail.com</a>   | <b>Médecine Nucléaire</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 21 67                               |
| <b>Mehdi MEJDOUBI</b><br><a href="mailto:mehdi.mejdoubi@chu-fortdefrance.fr">mehdi.mejdoubi@chu-fortdefrance.fr</a>                      | <b>Radiodiagnostic et imagerie Médicale</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 21 84             |
| <b>Rémi NEVIERE</b><br><a href="mailto:Remi.Neviere@chu-martinique.fr">Remi.Neviere@chu-martinique.fr</a>                                | <b>Physiologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 20 00                                      |

**Christian SAINTE-ROSE**  
[chsainterose@gmail.com](mailto:chsainterose@gmail.com)

**Radiodiagnostic et imagerie Médicale**  
CHU de FORT- DE - FRANCE  
Tel : 05 96 55 20 00

**Professeurs des Universités - Praticiens Hospitaliers  
(Suite)**

|  |   |
|--|---|
| <b>Sébastien BREUREC</b><br><a href="mailto:sebastien.breurec@chu-guadeloupe.fr">sebastien.breurec@chu-guadeloupe.fr</a> | <b>Bactériologie &amp; Vénéréologie</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tel : 05 90 89 12 80 |
| <b>Félix DJOSSOU</b><br><a href="mailto:felix.djossou@ch-cayenne.fr">felix.djossou@ch-cayenne.fr</a>                     | <b>Maladies infectieuses et tropicales</b><br>CH de CAYENNE<br>Tel : 05 94 39 ...                 |
| <b>Nicolas VENISSAC</b><br><a href="mailto:nicolas.venissac@chu-martinique.fr">nicolas.venissac@chu-martinique.fr</a>    | <b>Chirurgie thoracique et cardiovasculaire</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 ... |

**Professeurs Associés de Médecine Générale**

|  |  |
|--|--|
| <b>Franciane GANE-TROPLENT</b><br><a href="mailto:franciane.troplent@orange.fr">franciane.troplent@orange.fr</a> | <b>Médecine générale</b><br>Cabinet libéral les Abymes<br>Tel : 05 90 20 39 37 |
|--|--|

**Maître de Conférences des Universités - Praticiens Hospitaliers**

|   |   |
|---|---|
| <b>Christophe DELIGNY</b><br><a href="mailto:christophe.deligny@chu-fortdefrance.fr">christophe.deligny@chu-fortdefrance.fr</a>                     | <b>Médecine Interne</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 22 55   |
| <b>Jocelyn INAMO</b><br><a href="mailto:jocelyn.inamo@chu-fortdefrance.fr">jocelyn.inamo@chu-fortdefrance.fr</a>                                    | <b>Cardiologie</b><br>CHU de FORT- DE - FRANCE<br>Tel : 05 96 55 23 72 - Fax : 05 96 75 84 38                             |
| <b>Fritz-Line VELAYOUDOM épouse CEPHISE</b><br><a href="mailto:fritz-line.valayoudom@chu-guadeloupe.fr">fritz-line.valayoudom@chu-guadeloupe.fr</a> | <b>Endocrinologie</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tel : 05 90 89 13 03   |
| <b>Marie-Laure LALANNE-MISTRIH</b><br><a href="mailto:marie-laure.mistrih@chu-guadeloupe.fr">marie-laure.mistrih@chu-guadeloupe.fr</a>              | <b>Nutrition</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tel : 05 90 89 13 00  |
| <b>Narcisse ELENGA</b><br><a href="mailto:Narcisse.elenga@ch-cayenne.fr">Narcisse.elenga@ch-cayenne.fr</a>  | <b>Pédiatrie</b><br>CH de CAYENNE<br>Tel : 05 94 39 77 37   |
| <b>Moana GELU-SIMEON</b><br><a href="mailto:moana.simeon@chu-guadeloupe.fr">moana.simeon@chu-guadeloupe.fr</a>                                      | <b>Gastroentérologie hépatologie</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel : 05 90 89 10 10                              |
| <b>TABUE TEGUO Maturin</b><br><a href="mailto:tabue.maturin@chu-guadeloupe.fr">tabue.maturin@chu-guadeloupe.fr</a>                                  | <b>Médecine interne : Gériatrie et Biologie du vieillissement</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tel : 05 90 89 10 10 |

|   |  |
|---|--|
| <b>BACCINI Véronique</b><br><a href="mailto:veronique.baccini@chu-guadeloupe.fr">veronique.baccini@chu-guadeloupe.fr</a>            | <b>Hématologie</b><br>CHU de POINTE-A-PITRE/ABYMES<br>Tél : 05 90 89 10 10                   |
| Chefs de Clinique des Universités - Assistants des Hôpitaux   |  |
| <b>BANCEL Paul</b><br><a href="mailto:paul@bancel.fr">paul@bancel.fr</a>  | <b>ORL/Chirurgie maxillo faciale</b><br>CHU de Pointe-à-Pitre<br>Tél. : Tél. : 0590 89 14 60 |
| <b>BORJA DE MOZOTA Daphné</b><br><a href="mailto:daphne.borjademozota@chu-guadeloupe.fr">daphne.borjademozota@chu-guadeloupe.fr</a> | <b>Gynécologie-Obstétrique</b><br>CHU de POINTE- À -PITRE/ABYMES<br>Tél. : 0590 89 19 80     |
| <b>DARCHE Louis</b><br><a href="mailto:louisdarche@yahoo.fr">louisdarche@yahoo.fr</a>   | <b>Chirurgie Digestive et Viscérale</b><br>CHU de Martinique<br>Tél. : 0596 55 20 00         |
| <b>DE RIVOYRE Benoît</b><br><a href="mailto:benoit.derivoyre@chu-guadeloupe.fr">benoit.derivoyre@chu-guadeloupe.fr</a>              | <b>Ophtalmologie</b><br>CHU de Pointe-à-Pitre<br>Tél. : 0590 89 14 50 / 0690 00 93 95        |
| <b>DEBBAGH Hassan</b><br><a href="mailto:hassan.debbagh.pro@gmail.com">hassan.debbagh.pro@gmail.com</a>                             | <b>Chirurgie thoracique</b><br>CHU de Martinique<br>Tél. : 0596 55 22 71                     |
| <b>DOURNON Nathalie</b><br><a href="mailto:nathalie.dournon@chu-guadeloupe.fr">nathalie.dournon@chu-guadeloupe.fr</a>               | <b>Maladies infectieuses</b><br>CHU de Pointe-à-Pitre<br>Tel : 05 90 89 10 10                |
| <b>GALLI-DARCHE Paola</b><br><a href="mailto:paola_g17@hotmail.com">paola_g17@hotmail.com</a>                                       | <b>Neurologie</b><br>CHU de Martinique<br>Tél. : 0596 55 20 00.                              |
| <b>GHASSANI Ali</b><br><a href="mailto:alighassani@hotmail.com">alighassani@hotmail.com</a>   | <b>Gynécologie-Obstétrique</b><br>CHU de Pointe-à-Pitre<br>Tél. : 0590 89 19 89              |
| <b>CHARMILLON Alexandre</b><br><a href="mailto:alexandre.charmillon@yahoo.fr">alexandre.charmillon@yahoo.fr</a>                     | <b>Anesthésie-Réanimation</b><br>CHU de Pointe-à-Pitre<br>Tél. : 0590 89 11 82               |
| <b>MARY Julia</b><br><a href="mailto:code.julia@gmail.com">code.julia@gmail.com</a>   | <b>Rhumatologie</b><br>CHU de Martinique<br>Tél. : 0596 55 23 52                             |
| <b>MOINET Florence</b><br><a href="mailto:moinet.florence@neuf.fr">moinet.florence@neuf.fr</a>                                      | <b>Rhumatologie-médecine interne</b><br>CHU de Martinique<br>Tél. : 0596 55 22 55            |
| <b>MONFORT Astrid</b><br><a href="mailto:monfort.astrid972@gmail.com">monfort.astrid972@gmail.com</a>                               | <b>Cardiologie</b><br>CHU de Martinique<br>Tél. : 0596 55 23 72                              |
| <b>MOUREAUX Clément</b><br><a href="mailto:clemmsss@gmail.com">clemmsss@gmail.com</a>   | <b>Urologie</b><br>CHU de Pointe-à-Pitre<br>Tél. : 0590 89 13 95                             |
| <b>NABET Cécile</b><br><a href="mailto:cecile.nabet@ch-cayenne.fr">cecile.nabet@ch-cayenne.fr</a>                                   | <b>Parasitologie et Mycologie</b><br>CH "Andrée ROSEMON" de Cayenne<br>Tél. : 0594 39 53 59  |



|   |  |
|---|--|
| <b>PARIS Eric</b><br><a href="mailto:pariseric13@gmail.com">pariseric13@gmail.com</a>                                     | <b>Réanimation</b><br>CHU de Pointe-à-Pitre<br>Tél. : 0590 89 10 10        |
| <b>PIERRE-JUSTIN Aurélie</b><br><a href="mailto:apierrejustin@hotmail.fr">apierrejustin@hotmail.fr</a>                    | <b>Neurologie</b><br>CHU de Pointe-à-Pitre<br>Tél. : 0590 89 13 40         |
| <b>Chefs de Clinique des Universités - Assistants des Hôpitaux</b><br><i>(Suite)</i>                                      |  |
| <b>SAJIN Ana Maria</b><br><a href="mailto:anamariasajin@yahoo.com">anamariasajin@yahoo.com</a>                            | <b>Psychiatrie</b><br>CHU de Martinique<br>Tél. : 0596 55 20 44            |
| <b>SEVERYNS Mathieu</b><br><a href="mailto:mathieu.severyns@chu-fortdefrance.fr">mathieu.severyns@chu-fortdefrance.fr</a> | <b>Chirurgie orthopédique</b><br>CHU de Martinique<br>Tél. : 0596 55 22 21 |

|   |   |
|---|---|
| <b>Chefs de Clinique des Universités – Médecine Générale</b>  |   |
| <b>CARRERE Philippe</b><br><a href="mailto:philippe.carrere@univ-antilles.fr">philippe.carrere@univ-antilles.fr</a> | <b>Médecine Générale</b><br>CHU de Pointe-à-Pitre /Cabinet<br>Tél. : 0590 8084 05 /Fax : 0590 99 33 07    |
| <b>PLACIDE Axiane</b><br><a href="mailto:a.placide@hotmail.fr">a.placide@hotmail.fr</a>                             | <b>Médecine Générale</b><br>CHU de Martinique / Cabinet<br>Tél. : 05 96 75 48 27                          |
| <b>NIEMETZKI Florence</b><br><a href="mailto:florence.niemetzky@ch-cayenne.fr">florence.niemetzky@ch-cayenne.fr</a> | <b>Médecine Générale</b><br>CH « Andrée Rosemon » de Cayenne/Cabinet<br>Tél. : 05 94 39 50 50 poste 59 28 |
| <b>MOUNSAMY Josué</b><br><a href="mailto:josuemounsamy@hotmail.fr">josuemounsamy@hotmail.fr</a>                     | <b>Médecine Générale</b><br>CHU de Pointe-à-Pitre /Cabinet  |

|  |   |
|--|---|
| <b>Professeurs EMERITES</b>  |   |
| <b>Georges JEAN-BAPTISTE</b><br><a href="mailto:gcd.jeanbaptiste@wanadoo.fr">gcd.jeanbaptiste@wanadoo.fr</a> | <b>Rhumatologie</b><br><b>CHU de FORT- DE - FRANCE</b><br>Tel : 05 96 55 23 52 - Fax : 05 96 75 84 44     |
| <b>Serge ARFI</b><br><a href="mailto:serge.arfi@wanadoo.fr">serge.arfi@wanadoo.fr</a>                        | <b>Médecine interne</b><br><b>CHU de FORT- DE – France</b><br>Tel : 05 96 55 22 55 - Fax : 05 96 75 84 45 |
| <b>Bernard CARME</b><br><a href="mailto:carme.bernard@wanadoo.fr">carme.bernard@wanadoo.fr</a>               | <b>Parasitologie</b><br>CH « Andrée Rosemon » de Cayenne/Cabinet<br>Tél. : 05 94 39 50 50                 |

# REMERCIEMENTS

## **Aux membres du jury**

### **À Monsieur le Président du jury, le Professeur Samir JABER,**

Vous me faites l'honneur de présider mon jury de thèse.  
Cher maître je souhaiterais vous remercier très sincèrement de m'avoir accueillie dans votre service et de votre soutien constant tout au long de mon parcours. Votre expertise, vos qualités d'enseignement et vos compétences suscitent mon admiration.  
Recevez ici l'expression de ma profonde considération.

### **À Monsieur le Professeur Michel CARLES,**

Je vous remercie d'avoir accepté d'être membre de mon jury et de juger mon travail.  
Votre soutien depuis le début de ce travail a été un honneur et je vous remercie pour cela. Votre arrivée en tant que coordonnateur du DES d'Anesthésie Réanimation des Antilles est sans aucun doute la meilleure chose qui pouvait arriver à mes successeurs, et c'est pour moi un plaisir immense de terminer mon cursus avec votre soutien.  
Soyez assuré de mon plus profond respect.

### **À Monsieur le Professeur Gérald CHANQUES,**

Je vous remercie d'avoir accepté de siéger à mon jury de thèse et de juger mon travail.  
Veuillez trouver ici l'expression de ma sincère reconnaissance pour ces riches enseignements dont j'ai pu bénéficier à vos côtés. C'est un honneur pour moi, d'avoir pu apprendre auprès de quelqu'un d'aussi humain, et j'en suis sûre, ma prise en charge globale des patients a énormément évolué grâce à vous.  
Soyez assuré de mon plus profond respect

### **À ma directrice de thèse, le Docteur Audrey DE JONG**

Ma chère directrice de thèse, merci d'avoir accepté de diriger ce travail avec tant d'énergie et de motivation. Ta disponibilité sans limites et ton talent m'ont permis d'avancer dans la bonne direction. Je voulais tout particulièrement te remercier pour la confiance que tu m'as toujours accordée pendant ces deux années à Montpellier. Merci pour ta gentillesse et ta bonne humeur.  
Sois assurée de ma plus profonde considération et de mon très sincère respect.

## **A ma famille**

Un grand merci à mes parents pour leur soutien sans failles durant toutes ces années, vous avez toujours été là, Vous êtes deux personnes formidables, généreux, droits, et terriblement drôles : Doudou ton humour a traversé les océans ! Mimi, sans tes choux, j'aurais probablement moins d'amis... je vous remercie pour tout très sincèrement!

A mon frangin, Briec dont je suis incroyablement fière! Ta remarquable intelligence et ton sens de l'humour me manquent, allez frangin, si on habitait dans le même pays pour une fois ? Un grand merci également à Charlène, personne la plus balèze sur terre pour être capable de te supporter tous les jours...

A Arnaud, mon Chéri, je ne pourrais jamais te remercier assez pour me supporter, avoir supporté nos déménagements, et mes cyclothymies de retour de garde (« on va faire du kite tout de suite maintenant??? » alternés aux « je vais dormir 18h d'affilée »). On a déjà réalisé un rêve en vivant sur notre bateau, et ils nous en restent encore tellement... et avec toi j'ai confiance, je sais qu'ils se réaliseront. Merci

A Sonia, Yohann et Cédric, et la réanimation chirurgicale de Rennes, sans qui je ne serais probablement pas Anesthésiste Réanimateur aujourd'hui. Merci pour ces pancartes, qui aurait cru que c'était les prémices d'un travail passionnant.

## **Aux Antilles :**

### **A mes chefs anesthésistes des Antilles**

Nicolas Durand, Golden Nugget ! Avoir eu la chance d'apprendre de quelqu'un d'aussi brillant a été un immense plaisir, tout ça avec sacrée dose de rigolade. Je ne regarderais jamais les pitons du carbet sans penser à jeugéo.com et la capitale de kentucky. Nibsou, SDF dans bananeraies... Thierry Lebrun, Stéphanie Tissier, Jean Claude Mamie, et toute l'équipe d'anesthésie du bloc central, merci de nous avoir pris comme on était au berceau, et de nous avoir appris à marcher.

### **A mes chefs de la réanimation des Antilles**

Mr Medhaoui, je vous remercie très sincèrement pour votre soutien pendant toutes ces années, la porte de votre bureau a toujours été ouverte pour m'écouter et je vous en remercie.

Ruddy, Cyril, Jean louis, Michel, Marie : merci pour tout, merci pour votre pédagogie toujours à l'aide d'une bonne quantité d'humour ! J'ai appris la réa avec vous, vous m'avez donné l'envie du travail bien fait, et le professionnalisme. C'est avec un immense regret que je vous quitterai, vous êtes une team parfaite !

Merci également aux nouveaux chefs, pour leur confiance qu'ils m'accordent pour ce semestre : Ronan, Shazima, Agathe, Anne Charlotte, Gweno. Un grand merci tout particulier à Clément et Jean pour le prêt de leur bureau : le remboursement au préjudice moral se jouera au Babaorhum !

### **A mes co internes des Antilles**

Christophe, le seul l'unique, mon bras droit, avec qui j'ai tout appris. Merci d'avoir été la pendant ces années, tu sais bien que tout est toujours plus facile avec toi !

A Laura, ma belle Laura, promis un jour, on fera des vacances à Marseille ;)

A mes formidables coworker, mention particulière aux affreux de la réa : Sebas, Gweno, Titi, A mes collègues guadeloupéens Barthy, Amélie, Toto, tonton Yann... et bien sur JB, le chouchou aux yeux bleus parti trop tôt.

**A toutes ces formidables rencontres des Antilles :** Jade et Ben, votre bonne humeur et votre pêche permanente me donnent toujours le sourire, merci d'être là. Réda et Maëlle, toujours un plaisir de partager des moments avec vous, Réda promis, le premier réveillé va chez jojo. Paulette, merci pour ton énergie, Clémi, Marine (mam), Marine (pssssshhhiiiiitttt), avoir partagé cette coloc avec vous restera à jamais dans ma mémoire. Morne Pitao vivra toujours ;) Hanna, Charly, Jeanne, Chacha, Juju, Momo, merci pour tous ces moments partagés !!

## **A Montpellier :**

### **A mes chefs de Montpellier :**

Je ne saurais jamais vous remercier assez pour votre accueil exceptionnel, Marie Geniez (ce soir on rentre pas tard...) Marion Lalande (l'alpha upgradée étoile), Géraldine (ce soir on rentre tard), Jacob (non, on ne veut pas de tes chats), Hélène (on retourne quand en bactério ?), Marine (tu m'as tout appris sur la communication auprès du Pr F\*\*\* ☺), Nordine (tu m'as aussi tout appris sur la communication auprès du Pr F\*\*\*\*, dans un autre style), Pascal Colson, merci pour votre confiance et vos enseignements.

Au DAR B : Samir, Gérald, Audrey, Mathieu, Fouad, Moussa, Marina, Julie, Marion, merci pour ce semestre de folie !! Un grand merci aux ARC pour leur aide, en particulier à Alberto !!

Au Dar C : Pierre François Perrigault, merci pour vos enseignements. Paul, des Antilles au rockstore, toujours présent, merci pour tout !

### **Aux formidables rencontres de Montpellier**

Guigui et Marie, big up national, ce qui est bien c'est que je sais qu'on se retrouve en Bretagne ! Personne à Montpell ne porte la vareuse aussi bien que toi mon Guigui !!! Peaufinez vos chansons de Céline et votre pelage du front, vous me manquez !!

A mes co internes de fou : Simon le roi du jeu de mot, je te jure, je lance le chapeau pointu ici aussi !! Clément (mon binôme tu me manques, taper à l'ordi sans toi, c'est nul et surtout c'est très dur quand je sais pas faire ☺), Yass (je te jure yass je savais pas que t'avais un truc de prévu), Rémy, Chacha, Ben, Pierre, Julie, Julien, vous m'avez faite rêvé cet été !! Aux copains du DAR Bee, Beber, Marco, Timo, Auré, Chris, Lise, Roro, Ludo, Nico, Alex : on va boire un verre ?

A tous les collègues croisés en DESC, DES, et autre TUSAR : Ju (merci encore d'avoir pris soin de ma momo), Guillaume, Geoffrey, Lucie...

**Aux champions de la Clinique St Jean :** Merci pour tous ces moments ensemble, Seb (petit chat), Laurette, Lulu, Nadjat, Sam, Damien, Soso, Adeline...l'équipe de choc des soins C !

## **A Partout, toujours, tout le temps... (mais surtout en Bretagne...)**

Camille et Jiem, un grand merci pour votre présence, votre soutien, permanent, du Monténégro aux Vieilles Charrues, en passant par la Birmanie, avec qui d'autres pourrais-je sauver la galaxie en swift ?

Momo et Roro, hahaha voilà, je rigole rien que de penser à vous ! Avec vous la vie s'arrête, Stanley, Délicat, Rockstore ou Rockstar, on n'a jamais rien lâché, vivement le prochain wk touristique !

Juju et Auré, merci pour toutes ces années !!! Des gens aussi bienveillants que vous ça n'existe pas !! Auréhou, je ne sais pas comment je ferais si tu ne me sauvais pas tout le temps !!

Hélène et Marin, du yudo aux pizzas d'Albert 1<sup>er</sup>, il s'en est passé du temps, et surtout beaucoup de kilomètres, et pourtant, impossible de m'imaginer sans vous... les Grenadines sans Captain Marinou (rouil?) n'auront pas la même saveur (de la vanille?)

Clélie et Manu, la danse de la séduction n'aura pas été nécessaire pour me combler ! Ravie que vous reveniez en Bretagne aussi vite, d'ailleurs, Cléloche, si t'as un créneau pour les vieilles...

A Emilie, mon hyperactive, allez viens au SAMU à Vannes, l'hélico à Belle-île, c'est plus sympa qu'à Tourcoing avoue!

A Fred et Guillermo, un jour vous apprendrez à jouer au « Bang » sans tricher, mais d'ici là, tous les tas de bois de la terre seront coupés...

A Marine et Quentin, merci pour toute votre amitié, depuis l'AFGSU, même avec tous les kilomètres, on ne s'est jamais vraiment quitté ! Marine, tu as éclairé mon externat, c'était beaucoup plus dôle à deux !

Guirec et Anne élise, ne bougez pas de Binic les choux, on arrive !!!!

Maud et Alex : quechua qechua, on vous attend aussi !!

Audrey et Guston : vous êtes tellement omniprésents que je ne savais pas où vous mettre ! Merci pour tous les choux, vous êtes ma plus belle réussite

Adrien et Anais : m'enfin, Drien, t'es parti beaucoup trop tôt, on avait Palet-Piscine-Rosé alias PPR prévu à partir de Novembre !!! On prendra soin d'Anais et de la petite Juliette c'est promis.

### **Aux affreux Di trebi**

Hadelin et Marco : toujours là, toujours présent, peut-être même les champions du monde ! C'est bien la première fois que vous ratez un truc! Merci pour votre amitié sans bornes de toute heure du jour et de la nuit !

Doudou et Kaka : j'espère qu'un jour vous me croirez pour momo et le sapin !!!!

Julo et Ade : merci pour toutes ces années de soutien mon Julo, je ne rattrape plus de clémentine sans penser à toi ! Ah oui et chapeau chinois pour garder vos poules quand vous serez à Tahiti !!

Kabi et Here : souvenirs éternels des canaries et de ton bronzage de BG, pourvu que la princesse des îles déteigne un peu sur toi (mais pas pour tout hein). J'ai déjà hâte que tu dormes au Rockstore !

Kément et Coco : Tao, tu veux un gâteau ? Des Philippines aux Açores, on se ferait bien encore une petite escale aux grenadines ?

Charlipopoooo : merci pour toute cette bonne humeur et ce sourire que tu promènes ou que tu ailles. Ta culture et ton sens des bonnes idées (toujours ?) rendent toujours les moments géniaux avec toi

A la Dream team de 2017 : Arthur, Oscar, Raphaëlle, Mathieu, Dalva, et à ceux à venir. Vous n'avez pas tous eu l'immense chance de regarder des reportages sur les baleines avec Tata Jeannot (big up Arthur) mais ne vous inquiétez pas, vous n'y couperez pas !!

**« Et partout, des urgences à la réanimation, y'aura toujours un con, avec un drapeau Breton... » Fatals picards  
« Kenavo à vous » Benny du 75**

## Table des matières

|  |           |
|--|-----------|
| <b>I-RESUME.....</b>   | <b>14</b> |
| A-Français.....  | 14        |
| B-Anglais.....   | 15        |
| <b>III-INTRODUCTION.....</b>   | <b>16</b> |
| <b>III-MATÉRIELS ET MÉTHODES.....</b>  | <b>18</b> |
| A-Schéma de l'étude.....   | 18        |
| B-Collecte des données.....  | 18        |
| C-Critères d'inclusion.....  | 18        |
| D-Objectifs principaux.....  | 19        |
| E-Analyses statistiques.....   | 19        |
| <b>IV-RESULTATS.....</b>   | <b>21</b> |
| A-Analyse descriptive et univariée.....  | 21        |
| B-Kaplan-Meier .....   | 22        |
| C-Analyse multivariée : modèle de Cox.....   | 23        |
| <b>V-DISCUSSION.....</b>   | <b>25</b> |
| A-Points forts et limites.....   | 28        |
| B-Implications cliniques.....  | 19        |
| <b>VI-CONCLUSIONS.....</b>   | <b>29</b> |
| <b>VII- MESSAGES CLES.....</b>   | <b>30</b> |
| <b>VIII-LISTE D'ABREVIATIONS.....</b>  | <b>31</b> |
| <b>IX-CONSENTEMENT ET ETHIQUE.....</b>   | <b>31</b> |
| <b>X-REFERENCES BIBLIOGRAPHIQUES.....</b>  | <b>32</b> |
| <b>XI-FIGURES et tables.....</b>   | <b>35</b> |
| A-Figure 1 : Diagramme de flux de l'étude.....   | 38        |
| B-Figure 2 : Pression motrice selon la mortalité à J90.....  | 39        |
| C-Figure 3 : Courbe de survie à J90 selon la pression motrice, la pression de plateau et la compliance chez les patients obèses et non obèses..... | 40        |
| D-Table 1 : Caractéristiques des patients obèses et non obèses.....  | 43        |
| E-Table 2 : Paramètres ventilatoires des patients selon la mortalité à J90.....  | 44        |
| F-Table 3 : Analyse multivariée selon le modèle de Cox.....  | 45        |
| G- Table supplémentaire 1 : caractéristiques des patients en SDRA obèses et non-obèses.....  | 47        |
| H- Table supplémentaire 2 : critères de jugement secondaire selon la mortalité à J90.....  | 48        |
| <b>XIII-SERMENT D'HIPPOCRATE.....</b>  | <b>49</b> |

## I-Résumé

### A-Résumé

**Introduction :** Une pression motrice élevée (pression plateau-pression expiratoire positive) dans le système respiratoire est associée à une mortalité plus élevée chez les patients en syndrome de détresse respiratoire aigüe (SDRA) non sélectionnés. Cependant, cette relation n'a jamais été étudiée chez les patients obèses présentant un SDRA. L'objectif principal de cette étude est d'évaluer la relation entre la mortalité à J90 et la pression motrice dans une population de patients ventilés présentant un SDRA, en réanimation, selon le statut d'obèse ou de non obèse.

**Méthodes :** Nous avons réalisé une étude monocentrique rétrospective à partir de données collectées prospectivement, concernant tous les patients présentant un SDRA, admis de manière consécutive dans une réanimation adulte médico-chirurgicale de Janvier 2009 à Mai 2017. Le diagnostic de SDRA était posé à partir des critères de Berlin et tous les patients étaient ventilés en ventilation mécanique protectrice. L'obésité était définie par un Indice de Masse Corporelle  $> 30 \text{ Kg/m}^2$ . La pression de plateau, la compliance pulmonaire, et la pression motrice étaient relevées dans les 24h suivant le diagnostic de SDRA et comparées entre les survivants et les non survivants à J90 chez les patients obèses et chez les patients non-obèses. Un modèle de Cox a été utilisé pour la mortalité à J90.

**Résultats :** Trois cents soixante-deux patients avec SDRA ont été inclus pour l'analyse, 262 (72%) non obèses et 100 (28%) obèses. Les taux de mortalité à J90 étaient respectivement de 47% (95%CI 40-53) dans le groupe des patients non-obèses et de 46% (95%CI 36-56) dans le groupe des patients obèses. La pression motrice à J1 dans le groupe de patients non obèses était significativement plus basse dans le groupe des survivants à J90 ( $11.9 \pm 4.2 \text{ cmH}_2\text{O}$ ) que chez les non survivants ( $15.2 \pm 5.2 \text{ cmH}_2\text{O}$ ,  $P < 0.001$ ). Au contraire, dans le groupe de patients obèses, la pression motrice à J1 n'était pas significativement différente parmi les survivants à J90 ( $13.7 \pm 4.5 \text{ cmH}_2\text{O}$ ) en comparaison aux non survivants ( $13.2 \pm 5.1 \text{ cmH}_2\text{O}$ ,  $P = 0.41$ ). Après une analyse multivariée sur le modèle de Cox, la pression de plateau (HR=1.04(95%CI, 1.01-1.07) par point supplémentaire,  $P = 0.01$ ), la compliance pulmonaire (HR=0.97(95%CI, 0.96-0.99) par point supplémentaire,  $P = 0.0002$ ) et la pression motrice (HR=1.07(95%CI, 1.04-1.10) par point supplémentaire,  $P < 0.0001$ ), étaient associées à la mortalité à J90 de manière indépendante chez les patients non obèses mais pas chez les patients obèses.

**Conclusion :** Contrairement aux patients non obèses avec un SDRA, la pression motrice n'est pas associée à la mortalité chez les patients obèses avec un SDRA. Nos résultats suggèrent que des réglages du ventilateur « standards » identiques à tous les patients peuvent être inadaptés s'ils ne tiennent pas compte de la mécanique ventilatoire et des caractères physiques du patient. En effet, le niveau de PEEP et la pression motrice résultante du système respiratoire est probablement modifiée selon les patients en raison de particularités anatomiques et physiologiques.

## **B-Abstract**

**Background:** High driving pressure (driving pressure=plateau pressure–positive end-expiratory pressure) across the respiratory system was associated with worse outcome in non-selected patients with acute respiratory distress syndrome (ARDS). However, the relation between driving pressure and mortality has never been studied in selected obese-ARDS patients. The main objective of this study was to evaluate the relationship between Day-90 mortality and driving pressure in a population with ARDS ventilated in intensive care unit (ICU) according to obesity status.

**Methods:** We conducted a retrospective single center study of prospectively collected data of all ARDS patients admitted consecutively to a mixed medical-surgical adult ICU from January 2009 to May 2017. ARDS was identified based on the Berlin criteria consensus definition and all patients were ventilated with lung-protective mechanical ventilation. Obesity was defined as a Body Mass Index  $\geq 30$  Kg/m<sup>2</sup>. Plateau pressure, compliance and driving pressure of the respiratory system within 24 hours of ARDS diagnosis were compared between survivors and non-survivors at day-90 and between obese and non-obese patients. Cox proportional hazard modeling was used for mortality at day-90.

**Results:** Three hundred and sixty-two patients with ARDS were included, 262 (72%) non-obese and 100 (28%) obese patients. Mortality rate at day-90 was respectively 47% (95%CI 40-53) in the non-obese and 46% (95%CI 36-56) in the obese patients. Driving pressure at day-1 in the non-obese patients was significantly lower in survivors at day-90 ( $11.9\pm 4.2$ cmH<sub>2</sub>O) than in non-survivors ( $15.2\pm 5.2$ cmH<sub>2</sub>O,  $P<0.001$ ). On the contrary, in the obese patients, driving pressure at day-1 was not significantly different between survivors at day-90 ( $13.7\pm 4.5$ cmH<sub>2</sub>O) and non-survivors ( $13.2\pm 5.1$ cmH<sub>2</sub>O,  $P=0.41$ ). After multivariate cox analysis, plateau pressure (HR=1.04(95%CI,1.01-1.07) for each point of increase,  $P=0.01$ ), compliance (HR=0.97(95%CI,0.96-0.99) for each point of increase,  $P=0.0002$ ) and driving pressure (HR=1.07(95%CI,1.04-1.10) for each point of increase,  $P<0.0001$ ), were independently associated with day-90 mortality in non-obese patients, but not in obese patients.

**Conclusions:** Contrary to non-obese-ARDS patients, driving pressure was not associated to mortality in obese-ARDS patients. Our results suggested that a pre-defined similar ventilator settings for both obese and non-obese patients may not fit all, since positive end-expiratory pressure requirements and resulting driving pressure of respiratory system might vary widely among patients because of individual anatomy and physiology.



## II-Background

Obesity has become a worldwide health concern. The prevalence of obese adults worldwide has risen significantly over 25 years [1]. Admissions to an intensive care unit (ICU) for complications of bariatric surgery or other surgical or medical reasons are becoming increasingly frequent in obese patients [2]. Obese patients represent a specific population in the ICU, particularly regarding respiratory care [3-5]. Acute Respiratory Distress Syndrome (ARDS) incidence is increased in obese patients [6, 7]. Response to specific treatments such as prone positioning [8] or noninvasive ventilation (NIV) preoxygenation is improved in this population [9-12]. The prognosis of ARDS is controversial, but overall it seems that ARDS obese patients have a lower mortality risk when compared with non-obese patients [7, 8, 13]. The pathophysiology of respiratory system management in obese patients differs from the non-obese patient. The negative effects of thoracic wall weight and abdominal fat mass on pulmonary compliance, leading to decreased functional residual capacity and arterial oxygenation, are exacerbated by a supine position and further worsened after general anesthesia and mechanical ventilation.

One of the main targets of respiratory critical care management of the obese patient is the successful management of the respiratory system. Some studies have suggested that higher driving pressure (driving pressure = plateau pressure (P<sub>plat</sub>) – positive end expiratory pressure (PEEP)) was associated with higher mortality in ARDS [14], with conflicting results [14-19].

However, no distinction was made between non-obese and obese patients through the different studies assessing the relationship between driving pressure and mortality. All the patients were included without focusing on specific populations. It bears noting that the respiratory system includes the lung and the chest wall, and that the plateau pressure is related

to both transalveolar pressure (“lung”) and transthoracic pressure (“chest”). Chest compliance may be decreased in the obese patients compared to the non-obese patients, being associated with an increase of transthoracic pressure [20]. Given the epidemiological and pathophysiological changes observed in this specific population of obese patients, one could hypothesize that the results found in non-obese patients cannot be extrapolated to obese patients without dedicated studies, and that the obesity status could be a confounding factor in the relationship between driving pressure and mortality in overall ARDS patients. To our knowledge, no study has specifically evaluated the relationship between mortality and driving pressure in ARDS obese patients.

The main objective of this study was to determine the influence of the obesity status on the relationship between day-90 mortality and driving pressure in a population with ARDS ventilated in ICU. The secondary objectives were to determine the influence of the obesity status on the relationship between day-90 mortality and plateau pressure and tidal compliance. Our hypotheses were that, contrary to non-obese patients, mortality was not associated with higher driving pressure, higher plateau pressure or lower compliance of the respiratory system in ARDS obese patients.

## **III-Materials and methods**

### **A-Study Design**

We conducted a retrospective analysis of prospectively collected data of all ARDS patients consecutively admitted to a 16-bed, mixed medical-surgical adult ICU in a university teaching hospital between January 2008 and Mai 2017. We obtained approval from the local scientific and ethics committee of the "Comité d'Organisation et de Gestion de l'Anesthésie Réanimation" (COGAR) of the Montpellier University Hospital, who stated that no informed consent of the patient or next of kin was required, because no change in care practices.

### **B-Data Collection**

Patient body weight and height were measured at the time of ICU admission. In accordance with international standards [21], patients with a body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup> were defined as obese. All consecutive obese patients hospitalized during the study period in a medical-surgical ICU were included in the study. Only the first admission of each obese patient was retained for analysis. Patient data were recorded by the ICU's in house physician and included demographics, anthropometrics, clinical and biological data on hospital admission, as well as the Simplified Acute Physiology Score II (SAPS II) (10), ICU admission diagnosis, category of admission (medical or surgical) and co morbidities. All ventilation data (plateau pressure, tidal volume, PEEP, driving pressure, compliance of the respiratory system) were recorded at day-1. Mechanical power at day-1 was calculated according to the definition used by Gattinoni et al.[22].

### **C-Inclusion criteria**

All consecutive ARDS patients were included. ARDS was identified based on the Berlin criteria consensus definition [23] : (1) Timing: onset within 1 week of a known clinical

insult or new or worsening respiratory symptoms. (2) Chest imaging: Bilateral opacities, not fully explained by effusions, lobar/lung collapse, or nodules. (3) Origin of edema: Respiratory failure not fully explained by cardiac failure or fluid overload. Need objective assessment (echocardiography) to exclude hydrostatic edema if there is no risk factor present. All included patients were ventilated with lung-protective mechanical ventilation as defined in the literature: low tidal volume 6ml/kg, limited plateau pressure and PEEP.

### **D-Endpoints**

ICU and hospital mortality rates were obtained using hospital electronic patient records. The primary endpoint was mortality rate at day-90. The secondary endpoints were ICU mortality rate, ICU and hospital length of stay, the duration of invasive mechanical ventilation, the use of post-extubation noninvasive ventilation, prone positioning rate, pneumothorax occurrence and presence of ventilator associated-pneumonia.

### **E-Statistical Analysis**

First, a descriptive analysis was performed, overall in non-obese and obese patients. Then a univariate analysis was done, according to survival at day-90 in non-obese and obese patients. Quantitative variables were expressed as mean (standard deviation [SD]) or median (interquartile range 25%–75%) and compared using the Student t-test or the Wilcoxon test as appropriate (Gaussian or non-Gaussian variables). Qualitative variables were expressed as numbers (percentage) and compared using the chi-square test or the Fisher test as appropriate.

Second, Received operating characteristic (ROC) curve analysis was performed to assess the ability of the driving pressure, plateau pressure and tidal compliance to predict mortality in the obese and non-obese groups. The best threshold was determined using the Youden index [24]. Then, Kaplan-Meier analysis was performed to determine the survival lifetimes for day-90 survival and a log-rank test was used to compare the two curves of

driving pressure, plateau pressure and tidal compliance according to the best threshold found for each variable. Hazard ratio (HR) of mortality at day-90 was obtained by the Cox method.

Third, multivariate Cox regression was performed to assess the relationship between driving pressure (forced variable) and mortality at day-90 in obese and non-obese patients. Interactions between variables were tested. All variables with p-value less than 0.20 in the univariate analysis were entered into the model and a stepwise procedure was used to select the final model. HR were provided for each variable included in the final model. As driving pressure, plateau pressure and tidal compliance are mathematically coupled and collinear within them, we used a specific Cox model for each variable, driving pressure (model 1), plateau pressure (model 2) and tidal compliance (model 3), for both non-obese and obese patients [15].

Statistical significance was considered at  $p < 0.05$  and p values were two-tailed. The statistical analysis was performed by the Medical Statistical Department of the Montpellier University Hospital with the help of statistical software (SAS, version 9.4; SAS Institute; Cary, NC).

## IV-Results

### A-Descriptive and univariate analysis

Of the 5409 patients admitted to the ICU during the study period, 400 patients with ARDS were identified. Figure 1 presents the flow chart of the study. Complete ventilatory data were available in 362 patients that were included, 262 (72%) non-obese patients and 100 (28%) obese patients. One hundred and twelve patients (28%) were already included in randomized studies; 7 in the PROSEVA study [25], 42 in the BIRDS study [26] and 49 in the LIVE study [27]. Main demographic characteristics of non-obese and obese included patients are detailed in Table 1 (see supplementary Table 1 for characteristics of overall ARDS non-obese and obese patients). The ventilatory characteristics of non-obese and obese included patients are shown in Table 2.

In non-obese patients, mortality rate in ICU and at day-90 were respectively of 44% (95%CI 38-50) and 47% (95%CI 40-53). Driving pressure at day 1 in the non-obese patients was significantly lower in survivors at day-90 ( $12\pm 4$  cmH<sub>2</sub>O) than in non-survivors ( $15\pm 5$  cmH<sub>2</sub>O,  $P < 0.001$ , Figure 2). Plateau pressure was also lower in survivors at day-90 ( $22\pm 6$  cmH<sub>2</sub>O) than in non-survivors ( $24\pm 6$  cmH<sub>2</sub>O,  $P = 0.002$ , Table 2), whereas tidal compliance was higher in survivors ( $37\pm 19$  ml/cmH<sub>2</sub>O) than in non-survivors ( $29\pm 11$  ml/cmH<sub>2</sub>O,  $P < 0.001$ , Table 2).

In obese patients, mortality rate in ICU and at day-90 were respectively of 41% (95%CI, 31-51) and 46% (95%CI, 36-56). Driving pressure at day-1 did not differ between survivors at day-90 ( $14\pm 5$  cmH<sub>2</sub>O) and non-survivors ( $13\pm 4$  cmH<sub>2</sub>O,  $P = 0.408$ , Figure 2). Plateau pressure and tidal compliance did not differ between survivors at day-90 ( $25\pm 5$  cmH<sub>2</sub>O and  $34\pm 17$  ml/cmH<sub>2</sub>O, respectively) and non-survivors ( $23\pm 5$  cmH<sub>2</sub>O,  $P = 0.258$ , and  $35\pm 16$  ml/cmH<sub>2</sub>O,  $P = 0.373$ , respectively, Table 2).

Main and secondary outcomes in included non-obese and obese patients according to the vital status at day-90 are summarized in Supplementary Table 2.

### **B-Kaplan-Meier analysis**

In non-obese patients, the optimal threshold of driving pressure for predicting day-90 mortality was 14 cmH<sub>2</sub>O (AUROC = 0.68 (95%CI, 0.62-0.75), Youden index = 0.29, sensitivity=61%, specificity=69%, negative predictive value= 63%, positive predictive value=67%). Figure 3A shows the Kaplan-Meier curves at day-90 in the low driving pressure group (driving pressure < 14 cmH<sub>2</sub>O) and the high driving pressure group (driving pressure ≥ 14 cmH<sub>2</sub>O). Mortality at day-90 was significantly higher in the high driving pressure group compared to the low driving pressure group (HR = 2.4 (95% CI, 1.7-3.4), P < 0.0001). The optimal threshold of plateau pressure for predicting day-90 mortality was 25 cmH<sub>2</sub>O (AUROC = 0.61 (95%CI, 0.54-0.68), Youden index = 0.15, sensitivity=52%, specificity=63%, negative predictive value= 61%, positive predictive value=55%). Figure 3B shows the Kaplan-Meier curves at day-90 in the low plateau pressure group (plateau pressure < 25 cmH<sub>2</sub>O) and the high plateau pressure group (plateau pressure ≥ 25 cmH<sub>2</sub>O). Mortality at day-90 was significantly higher in the high plateau pressure group compared to the low plateau pressure group (HR = 1.5 (95% CI, 1.1-2.2), P = 0.02). The optimal threshold of tidal compliance for predicting day-90 mortality was 31 mL/cmH<sub>2</sub>O (AUROC = 0.63 (95%CI, 0.56-0.70), Youden index = 0.21, sensitivity=69%, specificity=53%, negative predictive value= 65%, positive predictive value=56%). Figure 3C shows the Kaplan-Meier curves at day-90 in the low tidal compliance group (tidal compliance < 31 ml/cmH<sub>2</sub>O) and the high tidal compliance group (tidal compliance ≥ 31ml/cmH<sub>2</sub>O). Mortality at day-90 was significantly higher in the low tidal compliance group compared to the high tidal compliance group (HR = 1.8 (95% CI, 1.2-2.6), P = 0.002).

In obese patients, no optimal threshold of driving pressure, plateau pressure or tidal compliance for predicting day-90 mortality were identified (AUROC = 0.55 (95%CI, 0.43-0.56), 0.56 (95%CI, 0.45-0.68) and 0.55 (95%CI, 0.43-0.67) respectively). Figure 3A shows the Kaplan-Meier curves on day-90 in the low driving pressure group (driving pressure < 14 cmH<sub>2</sub>O) and the high driving pressure group (driving pressure ≥ 14 cmH<sub>2</sub>O), Figure 3B in the low plateau pressure group (plateau pressure <25 cmH<sub>2</sub>O) and in the high plateau pressure group (driving pressure ≥ 25 cmH<sub>2</sub>O), and Figure 3C in the low tidal compliance group (tidal compliance < 31 mL/cmH<sub>2</sub>O) and in the high tidal compliance group (tidal compliance ≥ 31 mL/cmH<sub>2</sub>O). Mortality at day-90 was not significantly higher in the high driving pressure group compared to the low driving pressure group (HR = 0.85 (95% CI, 0.47-1.54), P = 0.59), or in the high plateau pressure group compared to the low plateau pressure group (HR = 0.78 (95% CI, 0.43-1.40), P = 0.40), or in the low tidal compliance group compared to the high tidal compliance group (HR = 0.72 (95% CI, 0.39-1.31), P = 0.27).

### **C-Multivariate Cox analysis**

In non-obese-patients, after multivariate analysis, driving pressure (HR = 1.07 (95%CI, 1.04-1.10) for each point of increase of driving pressure, P < 0.0001), plateau pressure (HR = 1.04 (95%CI, 1.01-1.07) for each point of increase of plateau pressure, P = 0.01) and tidal compliance (HR = 0.97 (95%CI, 0.96-0.99) for each point of increase of tidal compliance, P = 0.0002) (Table 3A) were independently associated with day-90 mortality.

In obese patients, after multivariate analysis, nor driving pressure (HR = 1.00 (95%CI, 0.93-1.06) for each point of increase of driving pressure, P = 0.903), plateau pressure (HR = 0.99 (95%CI, 0.93-1.05) for each point of increase of plateau pressure, P = 0.661) or tidal



compliance (HR = 1.00 (95%CI, 0.98-1.01) for each point of increase of tidal compliance, P = 0.705) (Table 3B) were associated with day-90 mortality.

## V-Discussion

This is the first study to assess the relationship in between driving pressure and mortality in the specific population of ARDS obese critically ill patients. The major finding is that unlike non-obese-ARDS patients, driving pressure was not associated with mortality in obese-ARDS patients. These results were confirmed after survival and multivariate cox analysis, showing that driving pressure was not a predictive factor of mortality in obese patients, contrary to non-obese patients. Similar results were found for plateau pressure and tidal compliance.

Lung protective mechanical ventilation has been the standard of care since the beginning of the 21st century in ARDS patients. Several studies showed that an adjustment of ventilation could increase survival [28, 29] and reduce « ventilator induced lung injury » [16, 30]. This concept involves applying low tidal volume, and scaling it to the predicted body weight, to limit plateau pressure equal to or below 30 cmH<sub>2</sub>O and to set a high and titrated PEEP to patients in ARDS [31]. Furthermore, prone positioning [25] and neuromuscular blocker [32] use were studied in two randomized controlled and prospective French trials and showed an improved survival rate.

Recently Amato et al. [14] suggested that driving pressure was associated with mortality in ARDS. They performed a retrospective analysis of several randomized controlled trials in patients with ARDS comparing different PEEP levels at the same tidal volume or different tidal volume levels at the same PEEP, or a combination of both. They found that driving pressure was the stronger predictor of mortality as compared with plateau pressure. Moreover, Guérin et al. [15] confirmed these results in 2016, in a retrospective analysis of PROSEVA and ACURAYSIS trials. They found that driving pressure was a risk factor for death in ARDS patients with strict protective lung protective ventilation. However, in a recent retrospective observational analysis [17] performed in non-ARDS patients, driving pressure was not associated with hospital mortality. Until the current study, the relationship between

driving pressure and mortality had never been studied in an observational study separating obese from non-obese population.

The values of driving pressure found in the non-obese patients are in accordance with previous studies recently published. Guerin et al. [15] found that driving pressure averaged  $13.7 \pm 3.7$  and  $12.8 \pm 3.7$  cmH<sub>2</sub>O ( $P = 0.002$ ) in non survivors and survivors, respectively. Most recently, Bellani et al [16] found that patients with a driving pressure of greater than 14 cmH<sub>2</sub>O at day-1 of ARDS criteria had a higher mortality. This threshold of 14 cmH<sub>2</sub>O was the one found in non-obese patients in the present study, reinforcing the external validity of these results. In the current study, per each cmH<sub>2</sub>O increase, driving pressure was associated with 7% increase in the risk of death in non-obese patients, which was higher than the risk observed for plateau pressure (+4%), even though also significantly associated with mortality. These results are very close to those found by Guerin et al. [15] (+5% increase in the risk of death per each cm H<sub>2</sub>O increase in driving pressure). The slight difference (+7% vs +5%) could be explained by the separated analysis performed in the current study of non-obese vs obese patients. If driving pressure, plateau pressure and tidal compliance were significantly associated with an increased risk of death in non-obese patients, this was not the case in obese patients.

The main explanations of the differences observed between non-obese and obese groups in the relationship between driving pressure, plateau pressure, tidal compliance and mortality may be the following. First, pulmonary physiology differs in the obese patient compared to the non-obese patient. Abdominal pressure is increased in obese patients because of increased abdominal and visceral adipose tissue deposition. The capacity of the chest is reduced compared to non-obese individuals, because the diaphragm is passively pushed cranially. This results in obese patients in decreased pulmonary and thoracic compliance, a reduction of functional residual capacity (FRC), and an increased work of breathing,

compared to non-obese patients [33]. In obese patients, much of the pressure that is applied by the ventilator will be used to distend the chest wall rather than the lung. As such, the plateau pressure, which represents the pressure used to distend the chest wall plus lungs, may be high, but so will the pleural pressure, and hence there may not be an increase in transpulmonary pressure [34] with accompanying lung overdistension. These characteristics may explain the unreliability of driving pressure to predict severity of ARDS in obese patients. Second, in relation to these physiologic changes, obese ARDS patients were found to be very different from non-obese ARDS patients in epidemiological studies. Gong et al. [6] reported an association between increasing BMI and increasing development of ARDS. Higher BMI and obesity were associated with longer lengths of stay but not ARDS mortality after adjusting for baseline clinical factors [6]. Similarly to these results, Anzueto et al. [7] found that the obese patients were more likely to have significant complications during the course of ventilatory support including ARDS and acute renal failure, but there were no associations with increased duration of mechanical ventilation, length of stay or mortality. A recent study [35] confirmed these previous studies, showing that ICU-mortality did not differ between obese and non-obese patients, and that the medical category of admission was associated with worse prognosis than the surgical category of admission in obese ICU patients. One could hypothesize that ARDS in obese patients is a different entity than ARDS in non-obese patients. ARDS in obese patients may be less severe because of more atelectasis and less inflammatory process, with a calculated driving pressure not reflecting the real severity of ARDS in this specific population. A better diaphragmatic function in obese patients compared to non-obese patients could also partly explain the specificities of ARDS in obese patients. In an experimental study [36], diaphragmatic function was better in Zucker obese rats before and after mechanical ventilation, and might be related to the high transthoracic and transabdominal pressures that are observed in obese patients [37]. Prone

position was found to be safe and efficient in obese patients, in a retrospective study showing that this strategy was associated to better outcomes [8]. PaO<sub>2</sub> /FiO<sub>2</sub> ratio was more improved in the obese group than in the non-obese group (+88% vs +54%; P<0.04), and mortality significantly higher in the obese group than in the non-obese group [8].

### **A- Limitation and strengths**

The current study has some limitations. First, the design of the study was monocentric with a retrospective analysis. However, the data were collected prospectively with the ICU software, the management of ARDS patients was standardized, all ARDS patients receiving lung protective ventilation, and all the patients with ARDS from 2009 to 2017 were included. It is worth noting that only 28% of these patients were included in randomized controlled trials. This is a strength of this independent observational study, allowing an external validation of previous results issued from randomized controlled trials [14, 15]. Second, a few data are missing regarding the driving pressure (5/105 (5%) in obese patients and 33/290 (11%) in non-obese patients). However, this low amount of missing data can be considered as missing completely at random (MCAR) and therefore the data sample is likely still representative of the population included. Third, although weight was determined on ICU admission, we cannot exclude the possibility that fluids given prior to admission may have affected the BMI.

### **B- Clinical implications**

The results of the current study suggest that driving pressure may not be appropriate to assess the severity of ARDS obese patients. Assessing transpulmonary pressure using transoesophageal pressure could be particularly advised in obese ARDS patients, allowing to take into account increased chest wall pressure. A recent study examined the relationship between respiratory system and transpulmonary driving pressure, pulmonary mechanics and

day-28 mortality [38]. The results suggest that utilizing PEEP titration to target positive transpulmonary pressure via oesophageal manometry causes both improved elastance and driving pressures. Treatment strategies leading to decreased respiratory system and transpulmonary driving pressure at 24 h were found to be associated with improved day-28 mortality. In obese patients, Eichler et al. [39] showed that patients during laparoscopic bariatric surgery require high per-operative levels of PEEP to maintain a positive transpulmonary pressure throughout the respiratory cycle. In the critical care setting, Fumagalli et al. [40] aimed to determine the relationship between transpulmonary pressure, lung mechanics, and lung morphology in obese patients with acute respiratory failure. They found that in obesity, low-to-negative values of transpulmonary pressure predict lung collapse and intratidal recruitment/ derecruitment. Our results further support the use of transpulmonary pressure, rather than driving pressure, to monitor obese patients with ARDS.

## **VI-Conclusions**

Contrary to non-obese ARDS patients, day-90 mortality was not associated with higher driving pressure across the respiratory system in obese ARDS patients. We suspected that pre-defined ventilator settings similar for both obese and non-obese patients may not fit all, since PEEP requirements and resulting driving pressure of respiratory system might vary widely among patients because of individual anatomy and physiology. Measuring transpulmonary pressure using oesophageal pressure could be of interest in obese patients as a prognostic factor of mortality and in order to optimize the ventilatory settings (i.e, individualized PEEP).

## VII-Key messages

- Contrary to non-obese ARDS patients, driving pressure across the respiratory system in obese ARDS patients is not related to ICU or hospital mortality.
- The optimal threshold of driving pressure for predicting day-90 mortality in non-obese patients is 14, whereas no optimal threshold was identified in obese patients.
- After multivariate Cox analysis, driving pressure was still strongly associated with day-90 mortality in non-obese patients, contrary to obese patients.
- Pre-defined ventilator settings similar for both obese and non-obese patients may not fit all, since PEEP requirements and resulting driving pressure of respiratory system might vary widely among patients because of individual anatomy and physiology.
- Assessing transpulmonary pressure using transoesophageal pressure may be particularly relevant in obese patients to predict mortality and individualize strategies such as PEEP titration.

## **VIII-List of abbreviations**

ICU: Intensive Care Unit

NIV: Non Invasive Ventilation

ARDS: Acute Respiratory Distress Syndrome

PEEP: Positive End Expiratory Pressure

BMI: body mass index

SAPS: Simplified Acute Physiology Score

SD: Standard Deviation

HR: Hazard ratio

AUROC: Area Under Receiver Operating Characteristic Curve

CI: Confidence Interval

MCAR: Missing Completely At Random

## **IX-Ethics approval and consent to participate**

Approval from the local scientific and ethics committee of the "Comité d'Organisation et de Gestion de l'Anesthésie Réanimation" (COGAR) of the Montpellier University Hospital was obtained, who stated that no informed consent of the patient or next of kin was required, because no change in care practices.



## X-References

1. Afshin A, Forouzanfar MH, Reitsma MB, Sur P, Estep K, Lee A, Marczak L, Mokdad AH, Moradi-Lakeh M, Naghavi M *et al*: **Health Effects of Overweight and Obesity in 195 Countries over 25 Years**. *N Engl J Med* 2017, **377**(1):13-27.
2. Montravers P, Ribeiro-Parenti L, Welsch C: **What's new in postoperative intensive care after bariatric surgery?** *Intensive care medicine* 2015, **41**(6):1114-1117.
3. De Jong A, Molinari N, Pouzeratte Y, Verzilli D, Chanques G, Jung B, Futier E, Perrigault PF, Colson P, Capdevila X *et al*: **Difficult intubation in obese patients: incidence, risk factors, and complications in the operating theatre and in intensive care units**. *Br J Anaesth* 2015, **114**(2):297-306.
4. Mahul M, Jung B, Galia F, De Jong A, Coisel Y, Vaschetto R, Matecki S, Chanques G, Brochard L, Jaber S: **Spontaneous breathing trial and post-extubation work of breathing in morbidly obese critically ill patients**. *Crit Care* 2016, **In Press**.
5. Pepin JL, Timsit JF, Tamisier R, Borel JC, Levy P, Jaber S: **Prevention and care of respiratory failure in obese patients**. *The Lancet Respiratory medicine* 2016, **4**(5):407-418.
6. Gong MN, Bajwa EK, Thompson BT, Christiani DC: **Body mass index is associated with the development of acute respiratory distress syndrome**. *Thorax* 2010, **65**(1):44-50.
7. Anzueto A, Frutos-Vivar F, Esteban A, Bensalame N, Marks D, Raymondos K, Apezteguía C, Arabi Y, Hurtado J, González M *et al*: **Influence of body mass index on outcome of the mechanically ventilated patients**. *Thorax* 2011, **66**(1):66-73.
8. De Jong A, Molinari N, Sebbane M, Prades A, Futier E, Jung B, Chanques G, Jaber S: **Feasibility and effectiveness of prone position in morbidly obese patients with ARDS: A case-control clinical study**. *Chest* 2013, **143**(6):1554-1561.
9. Delay J-M, Sebbane M, Jung B, Nocca D, Verzilli D, Pouzeratte Y, Kamel ME, Fabre J-M, Eledjam J-J, Jaber S: **The effectiveness of noninvasive positive pressure ventilation to enhance preoxygenation in morbidly obese patients: a randomized controlled study**. *Anesth Analg* 2008, **107**(5):1707-1713.
10. Futier E, Constantin JM, Pelosi P, Chanques G, Massone A, Petit A, Kwiatkowski F, Bazin JE, Jaber S: **Noninvasive ventilation and alveolar recruitment maneuver improve respiratory function during and after intubation of morbidly obese patients: a randomized controlled study**. *Anesthesiology* 2011, **114**(6):1354-1363.
11. De Jong A, Futier E, Millot A, Coisel Y, Jung B, Chanques G, Baillard C, Jaber S: **How to preoxygenate in operative room: Healthy subjects and situations "at risk"**. *Ann Fr Anesth Reanim* 2014, **33**(7-8):457-461.
12. Constantin JM, Jaber S: **[Preoxygenation in obese patient with non-invasive pressure support ventilation: keep the pressure!]**. *Ann Fr Anesth Reanim* 2012, **31**(9):673-674.
13. O'Brien JM, Jr., Philips GS, Ali NA, Aberegg SK, Marsh CB, Lemeshow S: **The association between body mass index, processes of care, and outcomes from mechanical ventilation: a prospective cohort study**. *Crit Care Med* 2012, **40**(5):1456-1463.
14. Amato MB, Meade MO, Slutsky AS, Brochard L, Costa EL, Schoenfeld DA, Stewart TE, Briel M, Talmor D, Mercat A *et al*: **Driving pressure and survival in the acute respiratory distress syndrome**. *N Engl J Med* 2015, **372**(8):747-755.
15. Guerin C, Papazian L, Reignier J, Ayzac L, Loundou A, Forel JM: **Effect of driving pressure on mortality in ARDS patients during lung protective mechanical ventilation in two randomized controlled trials**. *Crit Care* 2016, **20**(1):384.
16. Bellani G, Laffey JG, Pham T, Fan E, Brochard L, Esteban A, Gattinoni L, van Haren F, Larsson A, McAuley DF *et al*: **Epidemiology, Patterns of Care, and Mortality for Patients With Acute Respiratory Distress Syndrome in Intensive Care Units in 50 Countries**. *Jama* 2016, **315**(8):788-800.

17. Schmidt MFS, Amaral A, Fan E, Rubenfeld GD: **Driving Pressure and Hospital Mortality in Patients Without ARDS: A Cohort Study.** *Chest* 2017.
18. Villar J, Martin-Rodriguez C, Dominguez-Berrot AM, Fernandez L, Ferrando C, Soler JA, Diaz-Lamas AM, Gonzalez-Higueras E, Nogales L, Ambros A *et al*: **A Quantile Analysis of Plateau and Driving Pressures: Effects on Mortality in Patients With Acute Respiratory Distress Syndrome Receiving Lung-Protective Ventilation.** *Crit Care Med* 2017, **45**(5):843-850.
19. Aoyama H, Petteuzzo T, Aoyama K, Pinto R, Englesakis M, Fan E: **Association of Driving Pressure With Mortality Among Ventilated Patients With Acute Respiratory Distress Syndrome: A Systematic Review and Meta-Analysis.** *Crit Care Med* 2017.
20. De Jong A, Chanques G, Jaber S: **Mechanical ventilation in obese ICU patients: from intubation to extubation.** *Crit Care* 2017, **21**(1):63.
21. **Executive summary of the clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults.** *Arch Intern Med* 1998, **158**(17):1855-1867.
22. Gattinoni L, Tonetti T, Cressoni M, Cadringher P, Herrmann P, Moerer O, Protti A, Gotti M, Chiurazzi C, Carlesso E *et al*: **Ventilator-related causes of lung injury: the mechanical power.** *Intensive Care Med* 2016, **42**(10):1567-1575.
23. Ranieri VM, Rubenfeld GD, Thompson BT, Ferguson ND, Caldwell E, Fan E, Camporota L, Slutsky AS: **Acute respiratory distress syndrome: the Berlin Definition.** *Jama* 2012, **307**(23):2526-2533.
24. De Jong A, Deras P, Martinez O, Latry P, Jaber S, Capdevila X, Charbit J: **Relationship between Obesity and Massive Transfusion Needs in Trauma Patients, and Validation of TASH Score in Obese Population: A Retrospective Study on 910 Trauma Patients.** *PLoS one* 2016, **11**(3):e0152109.
25. Guérin C, Reignier J, Richard J-C, Beuret P, Gacouin A, Boulain T, Mercier E, Badet M, Mercat A, Baudin O *et al*: **Prone positioning in severe acute respiratory distress syndrome.** *N Engl J Med* 2013, **368**(23):2159-2168.
26. **Early Spontaneous Breathing in Acute Respiratory Distress Syndrome (BiRDS)**  
<https://clinicaltrials.gov/ct2/show/NCT01862016>.
27. Jabaudon M, Godet T, Futier E, Bazin JE, Sapin V, Roszyk L, Pereira B, Constantin JM: **Rationale, study design and analysis plan of the lung imaging morphology for ventilator settings in acute respiratory distress syndrome study (LIVE study): Study protocol for a randomised controlled trial.** *Anaesthesia, critical care & pain medicine* 2017, **36**(5):301-306.
28. Amato MB, Barbas CS, Medeiros DM, Magaldi RB, Schettino GP, Lorenzi-Filho G, Kairalla RA, Deheinzelin D, Munoz C, Oliveira R *et al*: **Effect of a protective-ventilation strategy on mortality in the acute respiratory distress syndrome.** *N Engl J Med* 1998, **338**(6):347-354.
29. Brower RG, Matthay MA, Morris A, Schoenfeld D, Thompson BT, Wheeler A: **Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome.** *N Engl J Med* 2000, **342**(18):1301-1308.
30. Villar J, Blanco J, Anon JM, Santos-Bouza A, Blanch L, Ambros A, Gandia F, Carriedo D, Mosteiro F, Basaldua S *et al*: **The ALIEN study: incidence and outcome of acute respiratory distress syndrome in the era of lung protective ventilation.** *Intensive Care Med* 2011, **37**(12):1932-1941.
31. Guerin C, Papazian L: **Opening pressures in ARDS.** *Intensive Care Med* 2017, **43**(5):702-704.
32. Papazian L, Forel JM, Gacouin A, Penot-Ragon C, Perrin G, Loundou A, Jaber S, Arnal JM, Perez D, Seghboyan JM *et al*: **Neuromuscular blockers in early acute respiratory distress syndrome.** *N Engl J Med* 2010, **363**(12):1107-1116.
33. Pelosi P, Croci M, Ravagnan I, Vicardi P, Gattinoni L: **Total respiratory system, lung, and chest wall mechanics in sedated-paralyzed postoperative morbidly obese patients.** *Chest* 1996, **109**(1):144-151.

34. Mauri T, Yoshida T, Bellani G, Goligher EC, Carteaux G, Rittayamai N, Mojoli F, Chiumello D, Piquilloud L, Grasso S *et al*: **Esophageal and transpulmonary pressure in the clinical setting: meaning, usefulness and perspectives.** *Intensive Care Med* 2016, **42**(9):1360-1373.
35. De Jong A, Verzilli D, Sebbane M, Monnin M, Belafia F, Cisse M, Conseil M, Carr J, Jung B, Chanques G *et al*: **Medical Versus Surgical ICU Obese Patient Outcome: A Propensity-Matched Analysis to Resolve Clinical Trial Controversies.** *Crit Care Med* 2018.
36. De Jong A, Carreira S, Na N, Carillion A, Jiang C, Beuvin M, Lacorte JM, Bonnefont-Rousselot D, Riou B, Coirault C: **Diaphragmatic function is enhanced in fatty and diabetic fatty rats.** *PLoS one* 2017, **12**(3):e0174043.
37. Malhotra A, Hillman D: **Obesity and the lung: 3. Obesity, respiration and intensive care.** *Thorax* 2008, **63**(10):925-931.
38. Baedorf Kassis E, Loring SH, Talmor D: **Mortality and pulmonary mechanics in relation to respiratory system and transpulmonary driving pressures in ARDS.** *Intensive Care Med* 2016, **42**(8):1206-1213.
39. Eichler L, Truskowska K, Dupree A, Busch P, Goetz AE, Zollner C: **Intraoperative Ventilation of Morbidly Obese Patients Guided by Transpulmonary Pressure.** *Obes Surg* 2017.
40. Fumagalli J, Berra L, Zhang C, Pirrone M, Santiago RRS, Gomes S, Magni F, Dos Santos GAB, Bennett D, Torsani V *et al*: **Transpulmonary Pressure Describes Lung Morphology During Decremental Positive End-Expiratory Pressure Trials in Obesity.** *Crit Care Med* 2017, **45**(8):1374-1381.

## **XI-Figures et tables**

### **A. Figure 1. Flow Chart of the study.**

Of the 5409 patients admitted to the ICU during the study period, 363 patients with mild to severe ARDS were included, 262 (72%) non-obese and 100 (28%) obese.

### **B. Figure 2. Values of driving pressure according to day-90 mortality**

Driving pressure was calculated as the difference between plateau pressure and applied PEEP at Day 1. Driving pressure are given, according to the vital status at day 90 in three groups: overall population, non-obese group and obese population group. Results among survivors at day 90 are showed in white boxes and results among non survivors patient are showed in black boxes. Values are given as mean  $\pm$  SD.

#### **1. In the overall population**

Driving pressure at day 1 in the non-obese patients was significantly lower in survivors at day 90 ( $12.4 \pm 4.4 \text{ cmH}_2\text{O}$ ) than in non-survivors ( $14.7 \pm 5.1 \text{ cmH}_2\text{O}$ ,  $P < 0.001$ ).

#### **2. In the non-obese patients**

Driving pressure at day 1 in the non-obese patients was significantly lower in survivors at day 90 ( $11.9 \pm 4.2 \text{ cmH}_2\text{O}$ ) than in non-survivors ( $15.2 \pm 5.2 \text{ cmH}_2\text{O}$ ,  $P < 0.001$ ).

#### **3. In the obese patients**

Driving pressure at day 1 in the obese patients was not significantly different in survivors at day 90 ( $13.7 \pm 4.5 \text{ cmH}_2\text{O}$ ) in comparison with non-survivors ( $13.2 \pm 5.1 \text{ cmH}_2\text{O}$ ,  $P = 0.41$ ).

**C. Figure 3. Percentage of survival at day-90 after ICU admission according to driving pressure, plateau pressure and tidal compliance in non-obese and obese patients.**

ARDS = acute respiratory distress syndrome

**1. Driving pressure**

The optimal threshold of driving pressure for predicting day-90 mortality in non-obese patients was 14 (AUROC = 0.68 (95%CI, 0.62-0.75), Youden Index = 0.29, sensitivity=61%, specificity=69%, negative predictive value= 63%, positive predictive value=67%).

Mortality at day 90 was significantly lower in the low driving pressure group (<14 cmH<sub>2</sub>O) (HR = 2.4 (95% CI, 1.7-3.4), P < 0.0001) than in the high driving pressure group (≥ 14 cmH<sub>2</sub>O).

No optimal threshold of driving pressure for predicting day-90 mortality in obese patients was found (AUROC = 0.55 (95%CI, 0.43-0.56)). Mortality at day 90 was not significantly lower in obese patients in the low driving pressure group (<14 cmH<sub>2</sub>O) (HR = 0.85 (95% CI, 0.47-1.54), P = 0.59) than in the high driving pressure group (≥ 14 cmH<sub>2</sub>O).

**2. Plateau pressure**

The optimal threshold of plateau pressure for predicting day-90 mortality was 25 (AUROC = 0.61 (95%CI, 0.54-0.68), Youden Index = 0.15, sensitivity=52%, specificity=63%, negative predictive value= 61%, positive predictive value=55%). Mortality at day-90 was significantly higher in the high plateau pressure group (≥25 cmH<sub>2</sub>O) compared to the low plateau pressure group (<25 cmH<sub>2</sub>O, HR = 1.5 (95% CI, 1.1-2.2), P = 0.02).

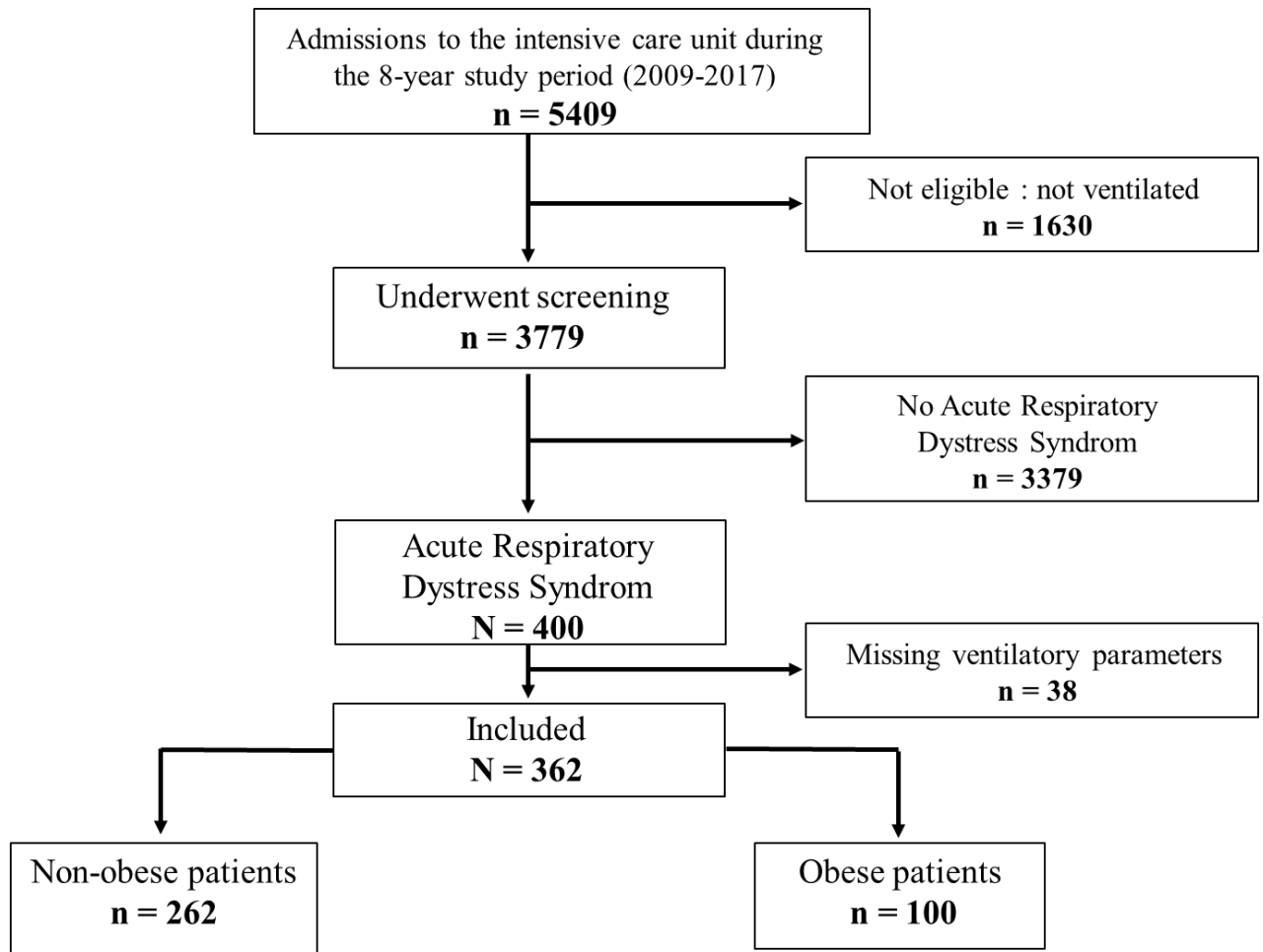
No optimal threshold of plateau pressure for predicting day-90 mortality was identified (AUROC = 0.56 (95%CI, 0.45-0.68)). Mortality at day-90 was not significantly higher in obese patients in the high plateau pressure group (≥25 cmH<sub>2</sub>O) compared to the low plateau pressure group (<25 cmH<sub>2</sub>O, HR = 0.78 (95% CI, 0.43-1.40), P = 0.40)).

### 3. Tidal compliance

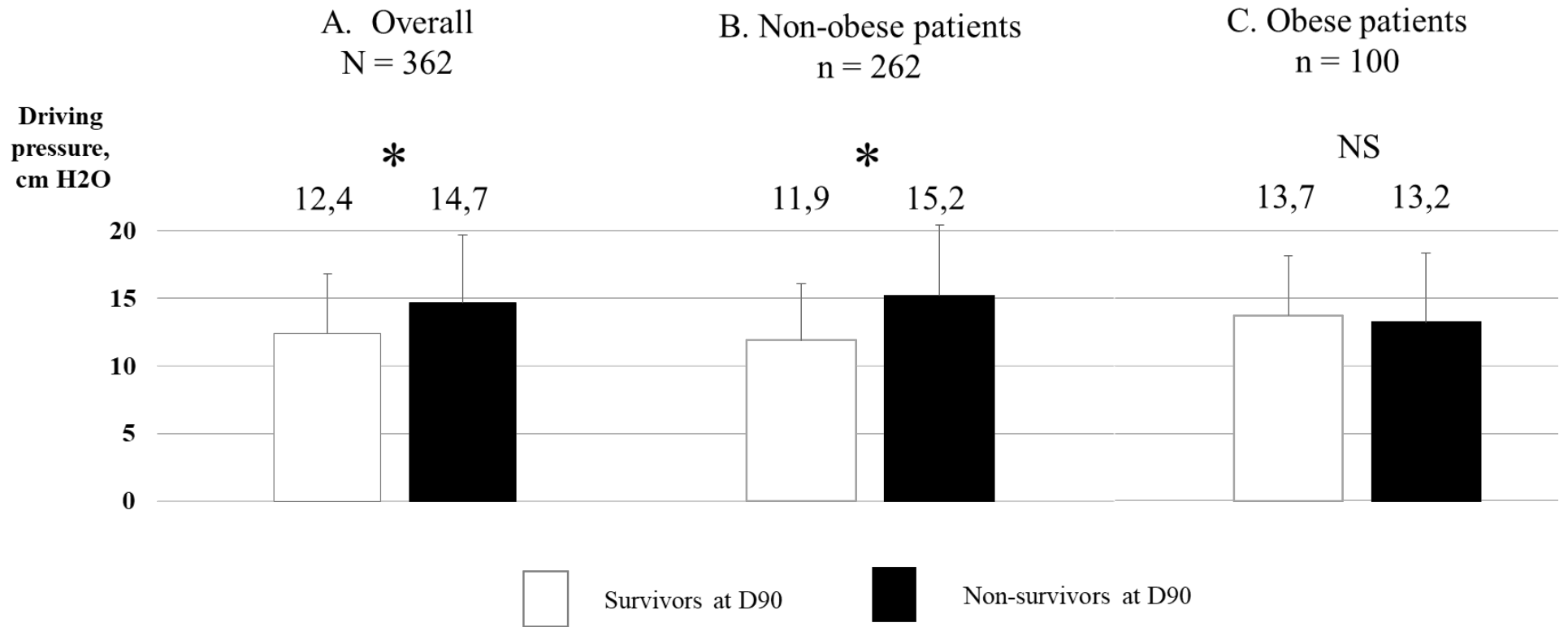
The optimal threshold of tidal compliance for predicting day-90 mortality was 31 (AUROC = 0.63 (95%CI, 0.56-0.70), Youden Index = 0.21, sensitivity=69%, specificity=53%, negative predictive value= 65%, positive predictive value=56%). Mortality at day-90 was significantly higher in the low tidal compliance group (<31 ml/cmH<sub>2</sub>O) compared to the high tidal compliance group (≥31 ml/cmH<sub>2</sub>O, HR = 1.8 (95% CI, 1.2-2.6), P = 0.002).

No optimal threshold of tidal compliance for predicting day-90 mortality in obese patients was identified (AUROC 0.55 (95%CI, 0.43-0.67)). Mortality at day-90 was not significantly higher in obese patients in the low tidal compliance group (<31 ml/cmH<sub>2</sub>O) compared to the high tidal compliance group (≥31 ml/cmH<sub>2</sub>O) (HR = 0.72 (95% CI, 0.39-1.31), P = 0.27).

**A. Figure 1**



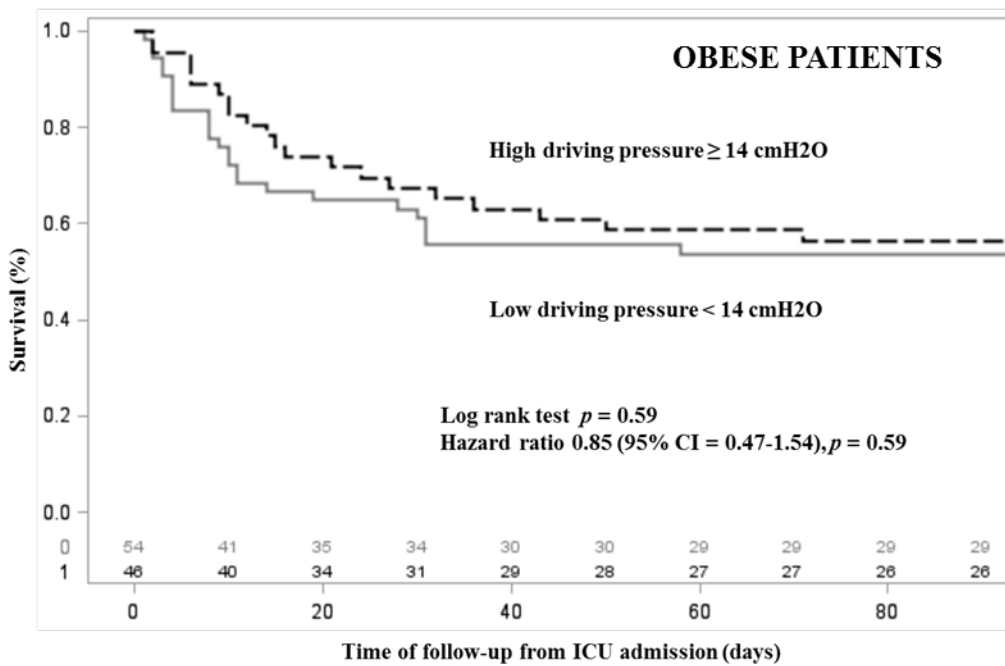
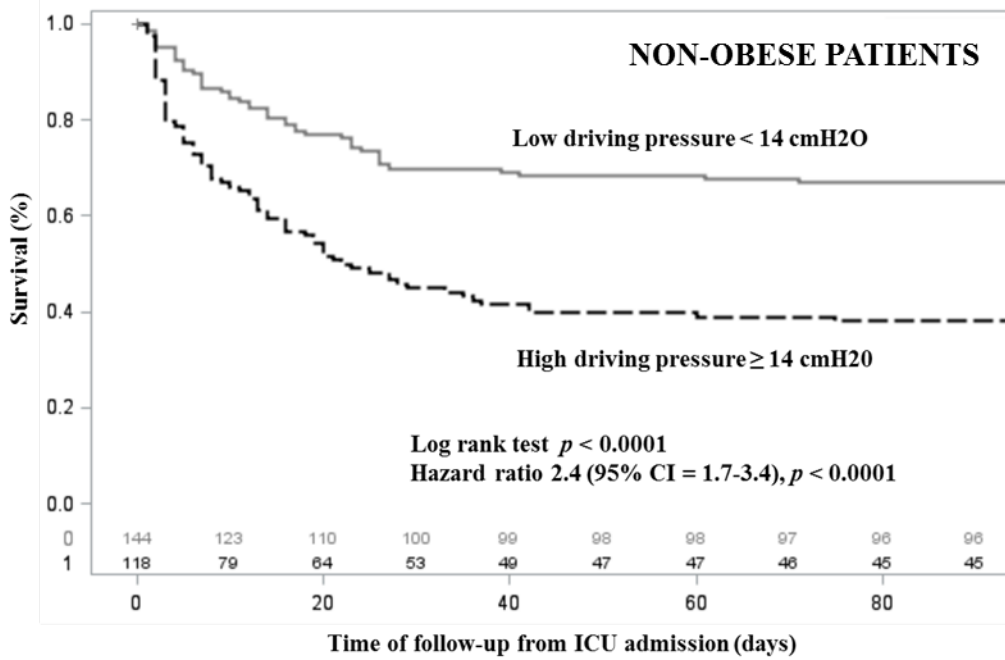
**B. Figure 2**



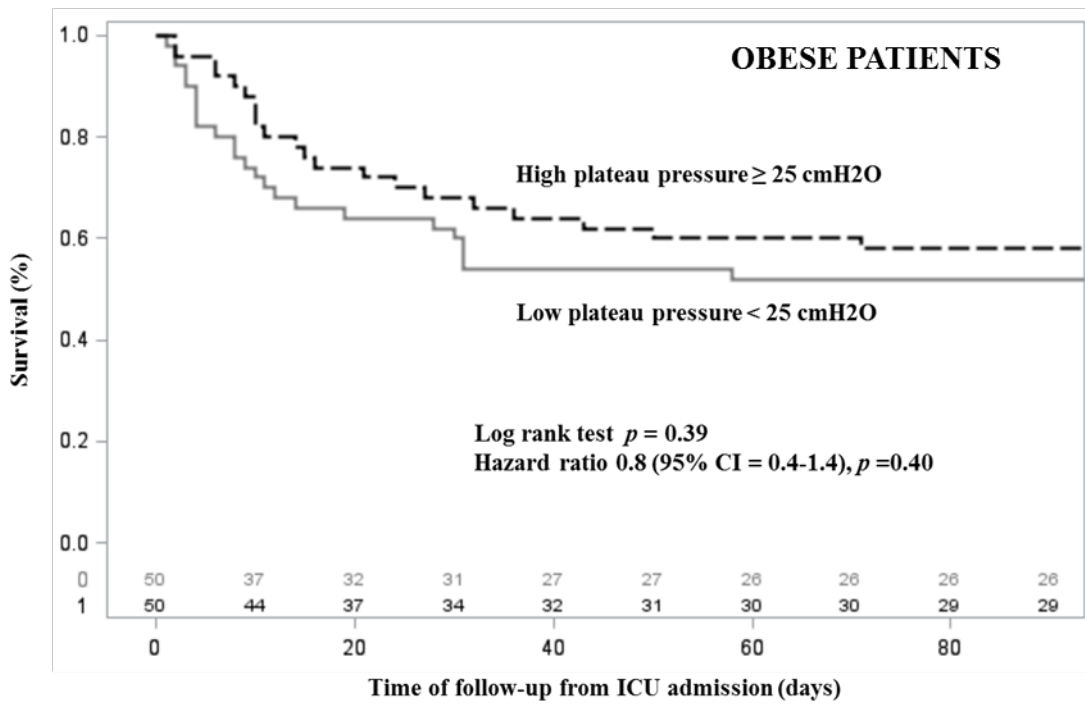
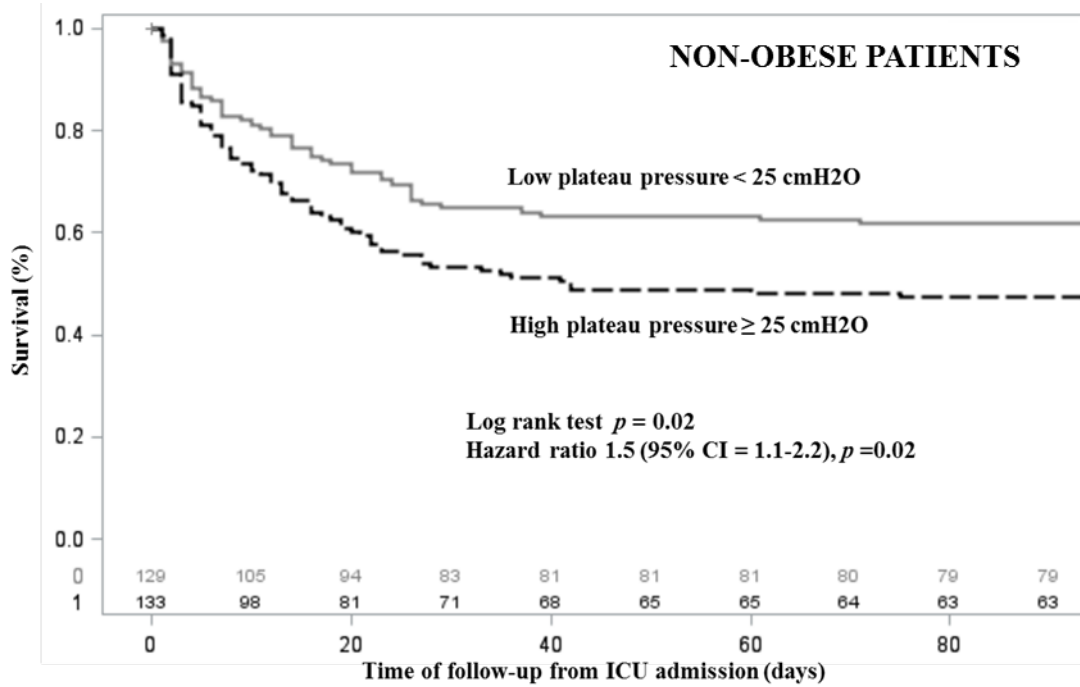


### C. Figure 3

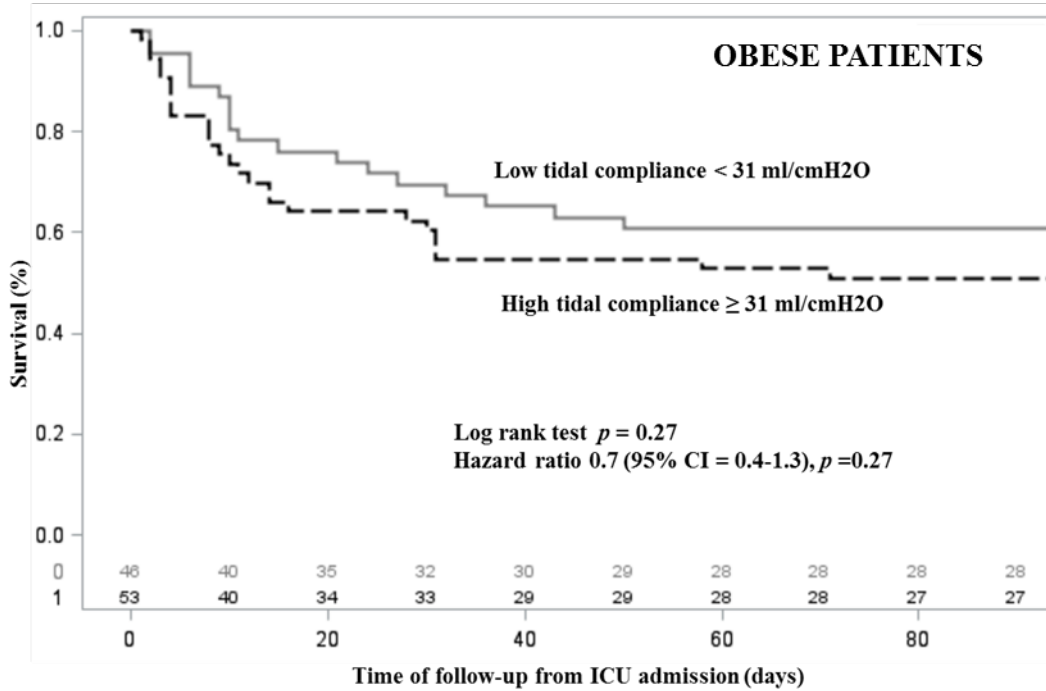
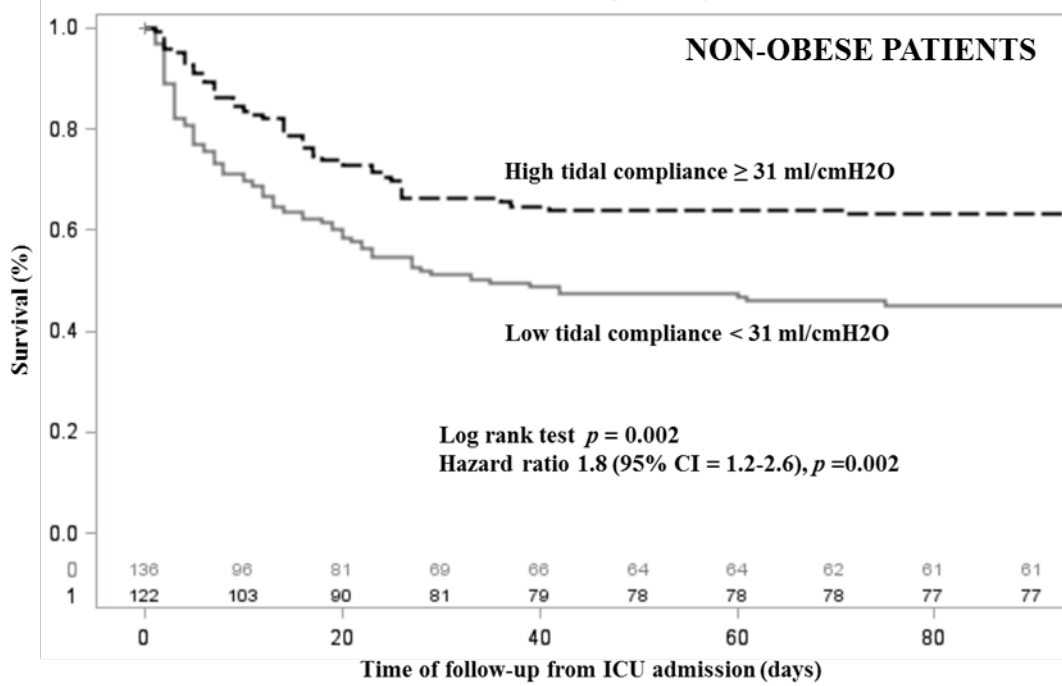
#### 1. Driving pressure



## 2. Plateau pressure



### 3. Tidal compliance



**D. Table 1.** Patients' characteristics in non-obese and obese patients

| Patients characteristics       | Overall (n = 362)      |                    | Non obese (n = 262)    |                            | <i>P</i> | Obese (n = 100)       |                           | <i>P</i> |
|--------------------------------|------------------------|--------------------|------------------------|----------------------------|----------|-----------------------|---------------------------|----------|
|                                | Non obese<br>(n = 262) | Obese<br>(n = 100) | Survivors<br>(n = 140) | Non-survivors<br>(n = 122) |          | Survivors<br>(n = 54) | Non-survivors<br>(n = 46) |          |
| Age, years                     | 61 ± 16                | 60 ± 11            | 59 ± 16                | 62 ± 16                    | 0.018    | 58 ± 12               | 63 ± 10                   | 0.048    |
| Male gender                    | 173 (66)               | 71 (71)            | 92 (66)                | 81 (66)                    | 0.908    | 35 (64)               | 40 (80)                   | 0.064    |
| BMI, kg/m <sup>2</sup>         | 24 ± 3                 | 36 ± 7             | 23 ± 3                 | 24 ± 3                     | 0.210    | 37 ± 8                | 35 ± 6                    | 0.470    |
| Admission SAPS II score        | 54 ± 17                | 51 ± 19            | 48 ± 14                | 60 ± 18                    | <.001    | 44 ± 16               | 60 ± 18                   | <.001    |
| Admission SOFA score           | 10 ± 5                 | 10 ± 5             | 8 ± 4                  | 12 ± 5                     | <.001    | 9 ± 4                 | 13 ± 5                    | <.001    |
| Current smoker                 | 94 (36)                | 38 (38)            | 56 (40)                | 38 (31)                    | 0.136    | 25 (46)               | 13 (28)                   | 0.064    |
| Chronic alcoholism             | 81 (31)                | 32 (32)            | 50 (36)                | 31 (25)                    | 0.114    | 13 (24)               | 19 (41)                   | 0.066    |
| Systemic arterial hypertension | 78 (30)                | 56 (56)            | 37 (26)                | 41 (34)                    | 0.205    | 29 (54)               | 27 (59)                   | 0.616    |
| Coronary artery disease        | 24 (9)                 | 10 (10)            | 8 (6)                  | 16 (13)                    | 0.038    | 4 (7)                 | 6 (13)                    | 0.349    |
| Respiratory disease            | 38 (15)                | 13 (13)            | 18 (13)                | 20 (16)                    | 0.417    | 8 (15)                | 5 (11)                    | 0.559    |
| Diabetes mellitus              | 32 (12)                | 33 (33)            | 17 (12)                | 15 (12)                    | 0.970    | 14 (26)               | 19 (41)                   | 0.103    |
| Chronic renal disease          | 24 (9)                 | 7 (7)              | 11 (8)                 | 13 (11)                    | 0.433    | 2 (4)                 | 5 (11)                    | 0.243    |
| Cirrhosis                      | 58 (22)                | 23 (23)            | 27 (19)                | 31 (25)                    | 0.234    | 8 (15)                | 15 (33)                   | 0.035    |
| Origin of ARDS                 |                        |                    |                        |                            |          |                       |                           |          |
| Primary                        | 123 (47)               | 39 (39)            | 70 (50)                | 53 (43)                    | 0.289    | 21 (39)               | 18 (39)                   | 0.980    |
| Secondary                      | 139 (53)               | 61 (61)            | 70 (50)                | 69 (57)                    | 0.289    | 33 (61)               | 27 (59)                   | 0.806    |
| ARDS severity                  |                        |                    |                        |                            |          |                       |                           |          |
| Mild                           | 22 (8)                 | 6 (6)              | 11 (8)                 | 11 (9)                     | 0.740    | 3 (6)                 | 3 (7)                     | 1.000    |
| Moderate                       | 117 (45)               | 49 (49)            | 70 (50)                | 47 (39)                    | 0.080    | 26 (48)               | 23 (51)                   | 0.769    |
| Severe                         | 123 (47)               | 45 (45)            | 59 (42)                | 64 (53)                    | 0.072    | 25 (46)               | 20 (44)                   | 0.854    |

Values given as mean ± SD or number (%), BMI, body mass index; SAPS, Simplified Acute Physiology Score; SOFA, Sepsis-related Organ Failure Assessment, ARDS, Acute Respiratory Distress Syndrome

**E. Table 2.** Ventilatory parameters in non-obese and obese patients, according to the vital status at Day 90

| Variables   | Overall (n = 362) |            | Non-obese (n = 262) |               | P     | Obese (n = 100) |               | P     |
|---|-------------------|------------|---------------------|---------------|-------|-----------------|---------------|-------|
|   | Non-obese         | Obese      | Survivors           | Non-survivors |       | Survivors       | Non-survivors |       |
|   | (n = 262)         | (n = 100)  | (n = 140)           | (n = 122)     |       | (n = 54)        | (n = 46)      |       |
| Biological parameters                             |                   |            |                     |               |       |                 |               |       |
| Arterial pH on day 1                              | 7.31 ± 0.1        | 7.35 ± 0.1 | 7.35 ± 0.1          | 7.28 ± 0.18   | <.001 | 7.34 ± 0.1      | 7.29 ± 0.18   | 0.025 |
| PaCO <sub>2</sub> on day 1, mmHg                  | 43 ± 6            | 45 ± 11    | 44 ± 11             | 43 ± 12       | 0.495 | 46 ± 12         | 43 ± 8        | 0.413 |
| PaO <sub>2</sub> on day 1, mmHg                   | 87 ± 36           | 85 ± 28    | 88 ± 37             | 84 ± 35       | 0.186 | 79 ± 16         | 93 ± 36       | 0.214 |
| PaO <sub>2</sub> /FIO <sub>2</sub> ratio on day 1 | 123 ± 57          | 121 ± 52   | 124 ± 54            | 121 ± 62      | 0.314 | 114 ± 47        | 130 ± 57      | 0.137 |
| Bicarbonate on day 1, g/mol                       | 23 ± 6            | 23 ± 5     | 25 ± 5              | 21 ± 6        | <.001 | 24 ± 5          | 21 ± 6        | 0.008 |
| Lactate on day 1 mmol/L                           | 4 ± 5             | 4 ± 5      | 2 ± 2               | 6 ± 6         | <.001 | 2 ± 2           | 5 ± 6         | 0.003 |
| Ventilation parameters*                           |                   |            |                     |               |       |                 |               |       |
| Respiratory rate on day 1, /minute                | 24 ± 4            | 24 ± 4     | 22 ± 4              | 25 ± 6        | 0.027 | 24 ± 4          | 24 ± 5        | 0.580 |
| Tidal volume on day 1, ml                         | 431 ± 92          | 450 ± 79   | 427 ± 87            | 435 ± 99      | 0.378 | 447 ± 86        | 452 ± 71      | 0.362 |
| Tidal volume on day 1, ml/PBW kg                  | 7 ± 1             | 7 ± 1      | 7 ± 1               | 7 ± 1         | 0.442 | 7 ± 1           | 7 ± 1         | 0.821 |
| PEEP on day 1, cmH <sub>2</sub> O                 | 9 ± 3             | 10 ± 3     | 9 ± 3               | 8 ± 3         | 0.123 | 10 ± 3          | 9 ± 3         | 0.206 |
| Peak pressure on day 1, cmH <sub>2</sub> O        | 35 ± 8            | 35 ± 6     | 35 ± 8              | 36 ± 8        | 0.914 | 37 ± 5          | 37 ± 7        | 0.173 |
| Plateau pressure on day 1, cmH <sub>2</sub> O     | 23 ± 6            | 24 ± 5     | 22 ± 6              | 24 ± 6        | 0.002 | 25 ± 5          | 23 ± 5        | 0.258 |
| Plateau pressure < 25 cmH <sub>2</sub> O          | 129 (49)          | 50 (50)    | 79 (56)             | 50 (41)       | 0.02  | 25 (46)         | 25 (54)       | 0.422 |
| Tidal compliance on day 1, ml/cmH <sub>2</sub> O  | 33 ± 16           | 34 ± 16    | 37 ± 19             | 29 ± 11       | <.001 | 34 ± 17         | 35 ± 16       | 0.373 |
| Tidal compliance < 31 ml/cmH <sub>2</sub> O       | 136 (53)          | 46 (46)    | 60 (44)             | 76 (63)       | 0.002 | 28 (52)         | 18 (40)       | 0.239 |
| Driving pressure on day 1, cmH <sub>2</sub> O     | 13 ± 5            | 13 ± 4     | 12 ± 4              | 15 ± 5        | <.001 | 14 ± 5          | 13 ± 4        | 0.408 |
| Driving pressure < 14 cmH <sub>2</sub> O          | 134 (51)          | 54 (54)    | 86 (69)             | 48 (39)       | <.001 | 29 (54)         | 25 (54)       | 0.949 |
| Mechanical power on day 1, J/min                  | 22 ± 7            | 24 ± 6     | 21 ± 7              | 22 ± 7        | 0.309 | 24 ± 6          | 24 ± 6        | 0.977 |

Quantitative values are expressed as mean ± SD and qualitative values are numbers (percentage of group). Tidal compliance of respiratory system was calculated as the ratio of tidal volume to driving pressure. Driving pressure was calculated as the difference between plateau pressure and applied positive end-expiratory pressure (PEEP). Mechanical power was calculated as the product of driving pressure in Newton (cm H<sub>2</sub>O × 0.098), tidal volume and respiratory rate [22]. Day 1 was defined as the 24 hours following the inclusion. PaO<sub>2</sub>/FIO<sub>2</sub> ratio the ratio of the partial pressure of arterial oxygen to the fraction of inspired oxygen, PaCO<sub>2</sub> partial pressure of arterial carbon dioxide, PBW predicted body weigh

**F. Table 3.** Results of multivariate cox regression for day-90 mortality prediction model from non-obese (n=262) and obese cohorts (n=100)

**1. Non-obese cohort**

**Model 1 including driving pressure**

| Variable                           | B Parameter | HR (95% CI)      | P Value |
|------------------------------------|-------------|------------------|---------|
| Driving pressure                   | 0.070       | 1.07 (1.04-1.10) | <0.0001 |
| SAPS II                            | 0.024       | 1.03 (1.01-1.04) | 0.0003  |
| SOFA at admission                  | 0.055       | 1.06 (1.01-1.11) | 0.033   |
| History of coronary artery disease | 0.93        | 2.53 (1.48-4.31) | 0.0007  |

*Definition of abbreviations:* CI = confidence interval; HR = hazard ratio; SAPS = Simple Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment

**Model 2 including plateau pressure**

| Variable                           | B Parameter | OR (95% CI)      | P Value |
|------------------------------------|-------------|------------------|---------|
| Plateau pressure                   | 0.038       | 1.04 (1.01-1.07) | 0.01    |
| SAPS II                            | 0.026       | 1.03 (1.01-1.04) | <0.0001 |
| SOFA at admission                  | 0.055       | 1.06 (1.01-1.11) | 0.030   |
| History of coronary artery disease | 0.88        | 2.43 (1.42-4.14) | 0.001   |

*Definition of abbreviations:* CI = confidence interval; OR = odds ratio; SAPS = Simple Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment

**Model 3 including tidal compliance**

| Variable                           | B Parameter | OR (95% CI)      | P Value |
|------------------------------------|-------------|------------------|---------|
| Tidal compliance                   | -0.028      | 0.97 (0.96-0.99) | 0.0002  |
| SAPS II                            | 0.026       | 1.03 (1.01-1.04) | <0.0001 |
| SOFA at admission                  | 0.057       | 1.06 (1.01-1.11) | 0.023   |
| History of coronary artery disease | 0.942       | 2.57 (1.50-4.37) | 0.0005  |

*Definition of abbreviations:* CI = confidence interval; OR = odds ratio; SAPS = Simple Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment

## 2. Obese cohort

### Model 1 including driving pressure

| Variable                         | B Parameter | OR (95% CI)      | P Value |
|----------------------------------|-------------|------------------|---------|
| Driving pressure                 | -0.004      | 1.00 (0.93-1.06) | 0.903   |
| SAPS II                          | 0.031       | 1.03 (1.01-1.05) | 0.003   |
| SOFA at admission                | 0.102       | 1.11 (1.02-1.20) | 0.016   |
| History of chronic heart failure | 0.897       | 2.45 (1.24-4.84) | 0.010   |

*Definition of abbreviations:* CI = confidence interval; OR = odds ratio; SAPS = Simple Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment

### Model 2 including plateau pressure

| Variable                         | B Parameter | OR (95% CI)      | P Value |
|----------------------------------|-------------|------------------|---------|
| Plateau pressure                 | -0.014      | 0.99 (0.93-1.05) | 0.661   |
| SAPS II                          | 0.030       | 1.03 (1.01-1.05) | 0.006   |
| SOFA at admission                | 0.104       | 1.11 (1.02-1.21) | 0.015   |
| History of chronic heart failure | 0.904       | 2.47 (1.25-4.88) | 0.009   |

*Definition of abbreviations:* CI = confidence interval; OR = odds ratio; SAPS = Simple Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment

### Model 3 including tidal compliance

| Variable                         | B Parameter | OR (95% CI)      | P Value |
|----------------------------------|-------------|------------------|---------|
| Tidal compliance                 | -0.003      | 1.00 (0.98-1.01) | 0.705   |
| SAPS II                          | 0.031       | 1.03 (1.01-1.05) | 0.003   |
| SOFA at admission                | 0.102       | 1.11 (1.02-1.20) | 0.016   |
| History of chronic heart failure | 0.875       | 2.40 (1.19-4.84) | 0.015   |

*Definition of abbreviations:* CI = confidence interval; OR = odds ratio; SAPS = Simple Acute Physiologic Score; SOFA = Sequential Organ Failure Assessment

**G. Supplementary Table 1.** Patients' characteristics in all the ARDS non-obese and obese patients

| Patients characteristics       | Overall (n = 400)      |                    | Non obese (n = 295)    |                            | P     | Obese (n = 105)       |                           | P     |
|--------------------------------|------------------------|--------------------|------------------------|----------------------------|-------|-----------------------|---------------------------|-------|
|                                | Non obese<br>(n = 295) | Obese<br>(n = 105) | Survivors<br>(n = 153) | Non-survivors<br>(n = 142) |       | Survivors<br>(n = 55) | Non-survivors<br>(n = 50) |       |
| Age, years                     | 61 ± 16                | 61 ± 11            | 59 ± 15                | 62 ± 16                    | 0.024 | 58 ± 12               | 63 ± 10                   | 0.026 |
| Male gender                    | 196 (66)               | 75 (71)            | 100 (65)               | 96 (68)                    | 0.682 | 35 (64)               | 40 (80)                   | 0.064 |
| BMI, kg/m <sup>2</sup>         | 24 ± 3                 | 36 ± 6             | 23 ± 3                 | 24 ± 3                     | 0.207 | 37 ± 8                | 36 ± 6                    | 0.617 |
| Admission SAPS II score        | 54 ± 18                | 52 ± 19            | 47 ± 14                | 61 ± 19                    | <.001 | 44 ± 16               | 61 ± 19                   | <.001 |
| Admission SOFA score           | 10 ± 6                 | 11 ± 5             | 8 ± 4                  | 12 ± 5                     | <.001 | 9 ± 4                 | 13 ± 5                    | <.001 |
| Current smoker                 | 109 (37)               | 40 (38)            | 63 (41)                | 46 (32)                    | 0.118 | 25 (45)               | 15 (30)                   | 0.103 |
| Chronic alcoholism             | 92 (31)                | 34 (32)            | 54 (35)                | 38 (27)                    | 0.114 | 13 (24)               | 21 (42)                   | 0.004 |
| Systemic arterial hypertension | 89 (36)                | 60 (57)            | 43 (28)                | 46 (32)                    | 0.424 | 30 (55)               | 30 (60)                   | 0.572 |
| Coronary arterial disease      | 25 (8)                 | 10 (10)            | 9 (6)                  | 17 (12)                    | 0.065 | 4 (7)                 | 6 (12)                    | 0.410 |
| Respiratory disease            | 45 (15)                | 13 (12)            | 21 (14)                | 24 (17)                    | 0.448 | 8 (15)                | 5 (10)                    | 0.480 |
| Diabetes mellitus              | 38 (13)                | 36 (34)            | 20 (13)                | 18 (13)                    | 0.924 | 15 (27)               | 21 (42)                   | 0.112 |
| Chronic renal disease          | 26 (9)                 | 7 (7)              | 13 (8)                 | 13 (9)                     | 0.842 | 2 (3.6)               | 5 (10)                    | 0.245 |
| Cirrhosis                      | 67 (22)                | 25 (24)            | 28 (18)                | 39 (27)                    | 0.060 | 9 (16)                | 16 (32)                   | 0.060 |
| Origin of ARDS                 |                        |                    |                        |                            |       |                       |                           |       |
| Primary                        | 142 (48)               | 40 (38)            | 75 (49)                | 67 (47)                    | 0.752 | 21 (38)               | 19 (38)                   | 0.985 |
| Secondary                      | 153 (52)               | 64 (61)            | 78 (51)                | 75 (53)                    | 0.752 | 34 (62)               | 30 (60)                   | 0.848 |
| ARDS severity                  |                        |                    |                        |                            |       |                       |                           |       |
| Mild                           | 26/291 (9)             | 5/104 (5)          | 15/153                 | 11/138 (8)                 | 0.58  | 3/55 (6)              | 2/49(4)                   | 0.74  |
| Moderate                       | 131/291 (45)           | 50/104 (48)        | 76/153                 | 55/138 (40)                | 0.09  | 26/55                 | 24/49 (49)                | 0.86  |
| Severe                         | 135/291 (46)           | 49/104 (47)        | 62/153                 | 73/138 (53)                | 0.03  | 26/55                 | 23/49 (47)                | 0.97  |

Values given as mean ± SD or number (%), BMI, body mass index; SAPS, Simplified Acute Physiology Score; SOFA, Sepsis-related Organ Failure Assessment, ARDS, Acute Respiratory Distress Syndrome



**H. Supplementary Table 2-** Main and secondary outcomes in non-obese and obese patients according to the vital status at day-90

| Outcomes                        | Overall (n = 362) |           | Non-obese (n = 262) |               | P     | Obese (n = 100) |               | P     |
|---------------------------------|-------------------|-----------|---------------------|---------------|-------|-----------------|---------------|-------|
|                                 | Non-obese         | Obese     | Survivors           | Non-survivors |       | Survivors       | Non-survivors |       |
|                                 | (n = 262)         | (n = 100) | (n = 140)           | (n = 122)     |       | (n = 54)        | (n = 46)      |       |
| Post extubation NIV             | 98 (37)           | 50 (50)   | 74 (53)             | 24 (20)       | <.001 | 36 (67)         | 14 (30)       | <.001 |
| At least one extubation failure | 63 (24)           | 20 (20)   | 37 (26)             | 26 (21)       | 0.334 | 9 (17)          | 11 (24)       | 0.367 |
| Ventilator associated pneumonia | 74 (28)           | 19 (19)   | 42 (30)             | 32 (26)       | 0.499 | 8 (15)          | 11 (24)       | 0.248 |
| Pneumothorax                    | 12 (5)            | 2 (2)     | 7 (5)               | 5 (4)         | 0.739 | 0 (0)           | 2(4)          | 0.209 |
| Prone position                  | 71 (27)           | 38 (38)   | 34 (24)             | 37 (30)       | 0.272 | 21 (39)         | 17 (37)       | 0.843 |
| ICU LOS, days                   | 19 ± 25           | 21 ± 29   | 22 ± 33             | 15 ± 18       | <.001 | 24 ± 29         | 20 ± 29       | 0.059 |
| In-hospital LOS, days           | 34 ± 41           | 33 ± 41   | 50 ± 47             | 16 ± 19       | <.001 | 44 ± 46         | 21 ± 30       | <.001 |
| Duration of MV, days            | 12 ± 17           | 12 ± 14   | 12 ± 20             | 10 ± 13       | 0.159 | 10 ± 11         | 13 ± 16       | 0.687 |
| ICU mortality                   | 116 (44)          | 41 (41)   | -                   | -             | -     | -               | -             | -     |
| Mortality at day 90             | 122 (47)          | 46 (46)   | -                   | -             | -     | -               | -             | -     |

Values given as mean ± SD or number (%), NIV, noninvasive ventilation; ICU, intensive care unit; LOS, length of stay; MV, mechanical ventilation

## SERMENT D'HIPPOCRATE

Au moment d'être admis à exercer la médecine, en présence des maîtres de cette école et de mes condisciples, je promets et je jure d'être fidèle aux lois de l'honneur et de la probité qui la régissent.

Mon premier souci sera, de rétablir, de préserver ou de promouvoir la santé dans tous les éléments physiques et mentaux, individuels collectifs et sociaux. Je respecterai toutes les personnes, leur autonomie et leur volonté, sans aucune discrimination selon leur état ou leurs convictions.

J'interviendrai pour les protéger si elles sont affaiblies, vulnérables ou menacées dans leur intégrité ou dignité.

Même sous la contrainte, je ne ferai usage de mes connaissances contre les lois de l'humanité.

J'informerai les patients de décisions envisagées, de leurs raisons et de leurs conséquences. Je ne tromperai jamais leur confiance et n'exploiterai pas le pouvoir hérité des circonstances pour forcer leurs consciences.

Je donnerai mes soins à l'indigent et à quiconque me les demandera.  
Je ne me laisserai influencer ni par la recherche du gain ni par la recherche de la gloire.

Admis dans l'intimité des personnes, je tairai les secrets qui me sont confiés.  
Reçu à l'intérieur des maisons, je respecterai les secrets des foyers.  
Et ma conduite ne servira pas à corrompre les mœurs.

Je ferai tout pour soulager les souffrances, sans acharnement.  
Je ne provoquerai jamais la mort délibérément.  
Je préserverai l'indépendance nécessaire à l'accomplissement de ma mission.  
Que je sois modéré en tout, mais insatiable de mon amour de la science.  
Je n'entreprendrai rien qui ne dépasse mes compétences ; je les entretiendrai et les perfectionnerai pour assurer au mieux les services qui me seront demandés.

J'apporterai mon aide à mes confrères ainsi qu'à leurs familles dans l'adversité.  
Que les hommes et mes confrères m'accordent leur estime si je suis fidèle à mes promesses,  
Que je sois déshonoré et méprisé si j'y manque.

**NOM : COSSIC**

**PRENOM : Jeanne**

**Sujet de la thèse : Impact de la pression motrice sur la mortalité chez les patients obèses et non obèses en SDRA : une étude de cohorte rétrospective**

**Thèse :** Médecine - Université des Antilles- Année 2018

**Numéro d'identification :**

**MOTS-CLES :** obésité, obèse, pression motrice, service de réanimation, syndrome de détresse respiratoire aiguë.

**Introduction :** Une pression motrice élevée (pression plateau-pression expiratoire positive) dans le système respiratoire est associée à une mortalité plus élevée chez les patients en syndrome de détresse respiratoire aiguë (SDRA) non sélectionnés. Cependant, cette relation n'a jamais été étudiée chez les patients obèses présentant un SDRA. L'objectif principal de cette étude est d'évaluer la relation entre la mortalité à J90 et la pression motrice dans une population de patients ventilés présentant un SDRA, en réanimation, selon le statut d'obèse ou de non obèse.

**Méthodes :** Nous avons réalisé une étude monocentrique rétrospective à partir de données collectées prospectivement, concernant tous les patients présentant un SDRA, admis de manière consécutive dans une réanimation adulte médico-chirurgicale de Janvier 2009 à Mai 2017. Le diagnostic de SDRA était posé à partir des critères de Berlin et tous les patients étaient ventilés en ventilation mécanique protectrice. L'obésité était définie par un Indice de Masse Corporelle  $> 30 \text{ Kg/m}^2$ . La pression de plateau, la compliance pulmonaire, et la pression motrice étaient relevées dans les 24h suivant le diagnostic de SDRA et comparées entre les survivants et les non survivants à J90 chez les patients obèses et chez les patients non-obèses. Un modèle de Cox a été utilisé pour la mortalité à J90.

**Résultats :** Trois cents soixante-deux patients avec SDRA ont été inclus, 262 (72%) non obèses et 100 (28%) obèses. Les taux de mortalité à J90 étaient respectivement de 47% (95%CI 40-53) dans le groupe des patients non-obèses et de 46% (95%CI 36-56) dans le groupe des patients obèses. La pression motrice à J1 dans le groupe de patients non obèses était significativement plus basse dans le groupe des survivants à J90 ( $11.9 \pm 4.2 \text{ cmH}_2\text{O}$ ) que chez les non survivants ( $15.2 \pm 5.2 \text{ cmH}_2\text{O}$ ,  $P < 0.001$ ). Au contraire, dans le groupe de patients obèses, la pression motrice à J1 n'était pas significativement différente parmi les survivants à J90 ( $13.7 \pm 4.5 \text{ cmH}_2\text{O}$ ) en comparaison aux non survivants ( $13.2 \pm 5.1 \text{ cmH}_2\text{O}$ ,  $P = 0.41$ ). Après une analyse multivariée sur le modèle de Cox, la pression motrice (HR=1.07(95%CI,1.04-1.10) par point supplémentaire,  $P < 0.0001$ ), la pression de plateau (HR=1.04(95%CI,1.01-1.07) par point supplémentaire,  $P = 0.01$ ) et la compliance pulmonaire (HR=0.97(95%CI,0.96-0.99) par point supplémentaire,  $P = 0.0002$ ) étaient associées à la mortalité à J90 de manière indépendante chez les patients non obèses mais pas chez les patients obèses.

**Conclusion :** Contrairement aux patients non obèses avec un SDRA, la pression motrice n'est pas associée à la mortalité chez les patients obèses avec un SDRA. Nos résultats suggèrent que des réglages « standards » identiques à à tous les patients peuvent être inadaptés s'ils ne tiennent pas compte de la mécanique ventilatoire et des caractères physiques du patient. En effet, le niveau de PEEP et la pression motrice résultant du système respiratoire est probablement modifiée selon les patients en raison de particularités anatomiques et physiologiques.

**JURY :**

- Président : Pr JABER Samir
- Juges : Pr CARLES Michel  
Pr CHANQUES Gérald
- Directeur de Thèse : Dr DE JONG Audrey

**ADRESSE :** Kergonano 56870 BADEN