**Results**

Statistics were calculated using the R software [REF]. We set the significance threshold to 0.05 (α=0.05). Values are summarized with their mean value or with percentages where applicable, for uncertainty estimation we used 95% confidence intervals (95% CI). In other words, we report the mean and its 95% confidence interval in the format: mean [lower bound, upper bound]. When we could not simply calculate the CI from the sample (e.g., when working with group level proportions) we used bootstraping to estimate the uncertainty.

When comparing proportions between groups we used the proportions test. The Wilcoxon test was used when working with paired samples, while the Mann-Whitney test was used when working with independent samples. For survival analysis we used the Kaplan-Meier estimator. For analysing correlations between variables, we used (multivariate) linear regression models.

All the code for our analysis along with anonymized data is published at https://github.com/demsarjure/vein\_ablation.

*REF = R Core Team (2021). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.*

**1. Demographic data**

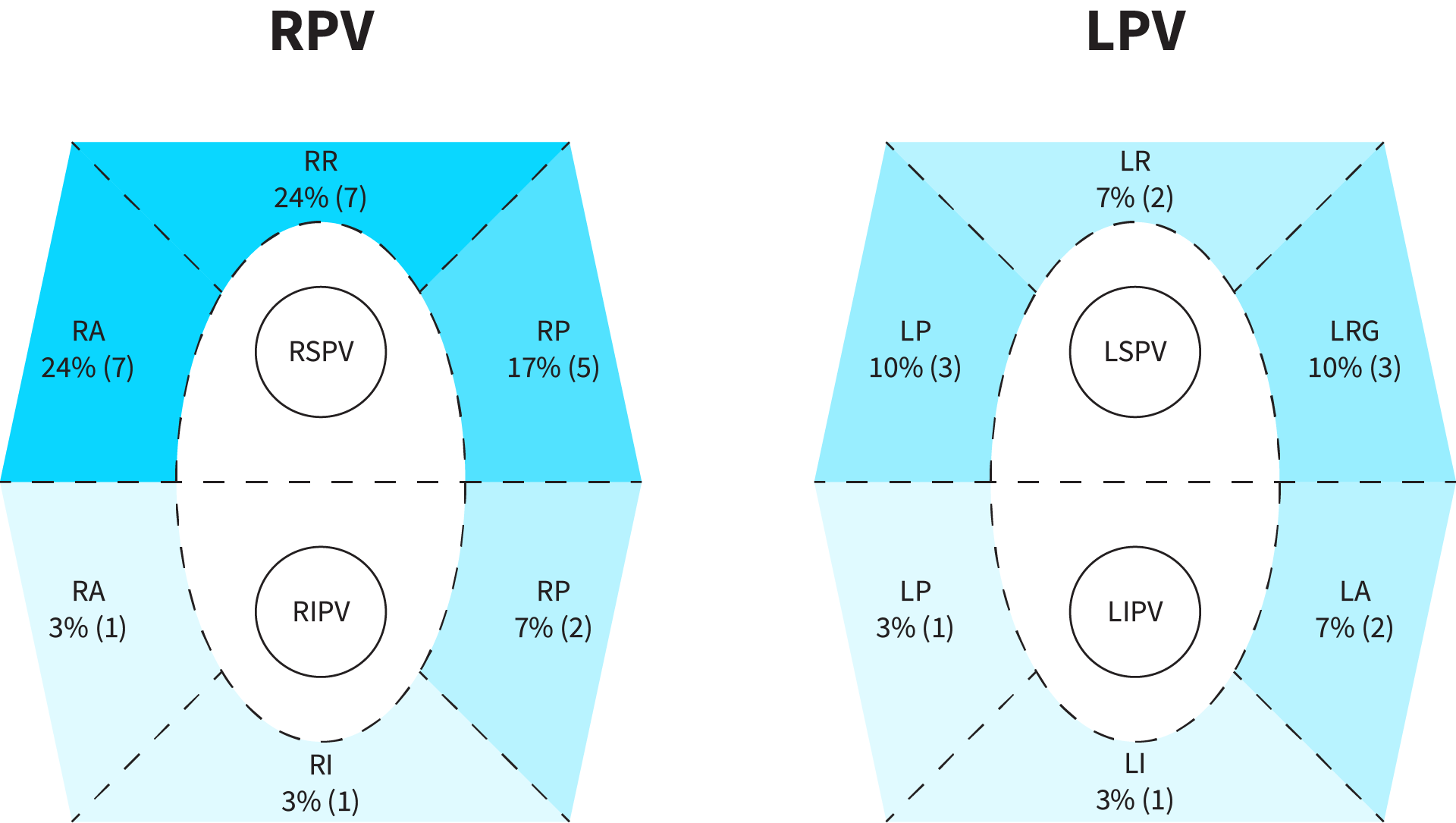
|  |  |  |  |
| --- | --- | --- | --- |
|  | **close** | **high density** | **p** |
| **age** | 63.05 [58.99, 66.88] | 62.61 [59.83, 65.34] | 0.57 |
| **gender** | 50% [33.33%, 66.67%] | 65.52% [48.28%, 82.76%] | 0.29 |
| **bmi** | 29.69 [27.73, 31.75] | 27.98 [26.42, 29.57] | 0.46 |
| **la\_volume\_index** | 39.87 [35.93, 43.93] | 39.38 [35.72, 43.17] | 0.62 |
| **la\_size** | 41.1 [39.7, 42.53] | 41.38 [39.21, 43.59] | 0.95 |
| **lvedvi** | 60.6 [57.87, 63.33] | 58.78 [55.63, 61.89] | 0.64 |
| **lvef** | 66.57 [64.57, 68.63] | 65.22 [62.63, 67.78] | 0.47 |
| **class\_III\_drugs** | 33.33% [16.67%, 50%] | 27.59% [13.79%, 44.83%] | 0.84 |
| **class\_I\_drugs** | 43.33% [26.67%, 60%] | 31.03% [13.79%, 48.28%] | 0.48 |
| **beta\_blockers** | 56.67% [40%, 73.33%] | 55.17% [37.93%, 72.41%] | 1 |
| **anticoagulant** | 83.33% [70%, 96.67%] | 82.76% [68.97%, 96.55%] | 1 |
| **probnp** | 255.21 [195.28, 319.46] | 323.3 [168.57, 534.33] | 0.34 |
| **chf** | 3.33% [0%, 10%] | 3.45% [0%, 10.34%] | 1 |
| **hypertension\_history** | 56.67% [40%, 73.33%] | 41.38% [24.14%, 58.62%] | 0.36 |
| **age\_75** | 13.33% [3.33%, 26.67%] | 3.45% [0%, 10.34%] | 0.37 |
| **diabetes\_history** | 13.33% [3.33%, 26.67%] | 10.34% [0%, 24.14%] | 1 |
| **vascular\_disease** | 10% [0%, 23.33%] | 3.45% [0%, 10.34%] | 0.63 |
| **age\_65\_74** | 50% [33.33%, 66.67%] | 37.93% [20.69%, 55.17%] | 0.5 |
| **cha2ds2vasc** | 2 [1.5, 2.53] | 1.31 [0.93, 1.69] | 0.06 |
| **cied** | 3.33% [0%, 10%] | 3.45% [0%, 10.34%] | 1 |

**2. Procedural data**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **close** | **high density** | **p** |
| **skin\_skin\_time** | 131.47 [121.8, 141.03] | 144.1 [135.93, 152.93] | 0.08 |
| **la\_dwell\_time** | 114.47 [106.67, 122.53] | 124.79 [117.83, 132.41] | 0.06 |
| **ablation\_time** | 29.45 [26.65, 32.23] | 31.41 [28.26, 34.57] | 0.46 |
| **ablation\_time\_hd** | / | 2.27 [1.51, 3.08] | / |
| **hd\_map\_time** | / | 20.28 [17.76, 22.97] | / |
| **numer\_of\_rf\_lesions\_pvi** | 89.7 [82.6, 96.77] | 89.45 [82.45, 96.76] | 0.96 |
| **additional\_lesions\_hd** | / | 6.86 [4.52, 9.45] | / |
| **first\_pass\_rspv** | 76.67% [60%, 90%] | 86.21% [72.41%, 96.55%] | 0.54 |
| **first\_pass\_ripv** | 83.33% [70%, 96.67%] | 89.66% [75.86%, 100%] | 0.74 |
| **first\_pass\_lspv** | 83.33% [70%, 96.67%] | 96.55% [89.66%, 100%] | 0.21 |
| **first\_pass\_lipv** | 100% | 96.55% [89.66%, 100%] | 0.99 |
| **first\_pass\_per\_patient** | 60% [43.33%, 76.67%] | 79.31% [62.07%, 93.1%] | 0.18 |
| **cti** | 6.67% [0%, 16.67%] | 13.79% [3.45%, 27.59%] | 0.64 |
| **complication** | 0% | 3.45% [0%, 10.34%] | 0.99 |

**3. Segments and dormants**

|  |  |  |  |
| --- | --- | --- | --- |
| **lokacija** | | **število** | **delež** |
| **RPV** | **rspv\_rr** | 7 [3, 12] | 24.14% [10.34%, 41.38%] |
|  | **rspv\_ra** | 7 [2, 13] | 24.14% [6.9%, 44.83%] |
|  | **rspv\_rp** | 5 [1, 9] | 17.24% [3.45%, 31.03%] |
|  |  |  |  |
|  | **ripv\_ra** | 1 [0, 3] | 3.45% [0%, 10.34%] |
|  | **ripv\_rp** | 2 [0, 5] | 6.9% [0%, 17.24%] |
|  | **ripv\_ri** | 1 [0, 3] | 3.45% [0%, 10.34%] |
|  |  |  |  |
|  |  |  |  |
| **LPV** | **lspv\_lr** | 2 [0, 5] | 6.9% [0%, 17.24%] |
|  | **lspv\_lrg** | 3 [0, 7] | 10.34% [0%, 24.14%] |
|  | **lspv\_lp** | 3 [0, 7] | 10.34% [0%, 24.14%] |
|  |  |  |  |
|  | **lipv\_la** | 2 [0, 5] | 6.9% [0%, 17.24%] |
|  | **lipv\_li** | 1 [0, 3] | 3.45% [0%, 10.34%] |
|  | **lipv\_lp** | 1 [0, 3] | 3.45% [0%, 10.34%] |

****

**4. US after 12 months**

|  |  |  |  |
| --- | --- | --- | --- |
| **la\_volume\_index\_12** | **la\_volume\_index** | **razlika** | **p** |
| 41.27 [38.61, 44.03] | 39.63 [36.95, 42.39] | 1.64 [-0.71, 4] | 0.25 |

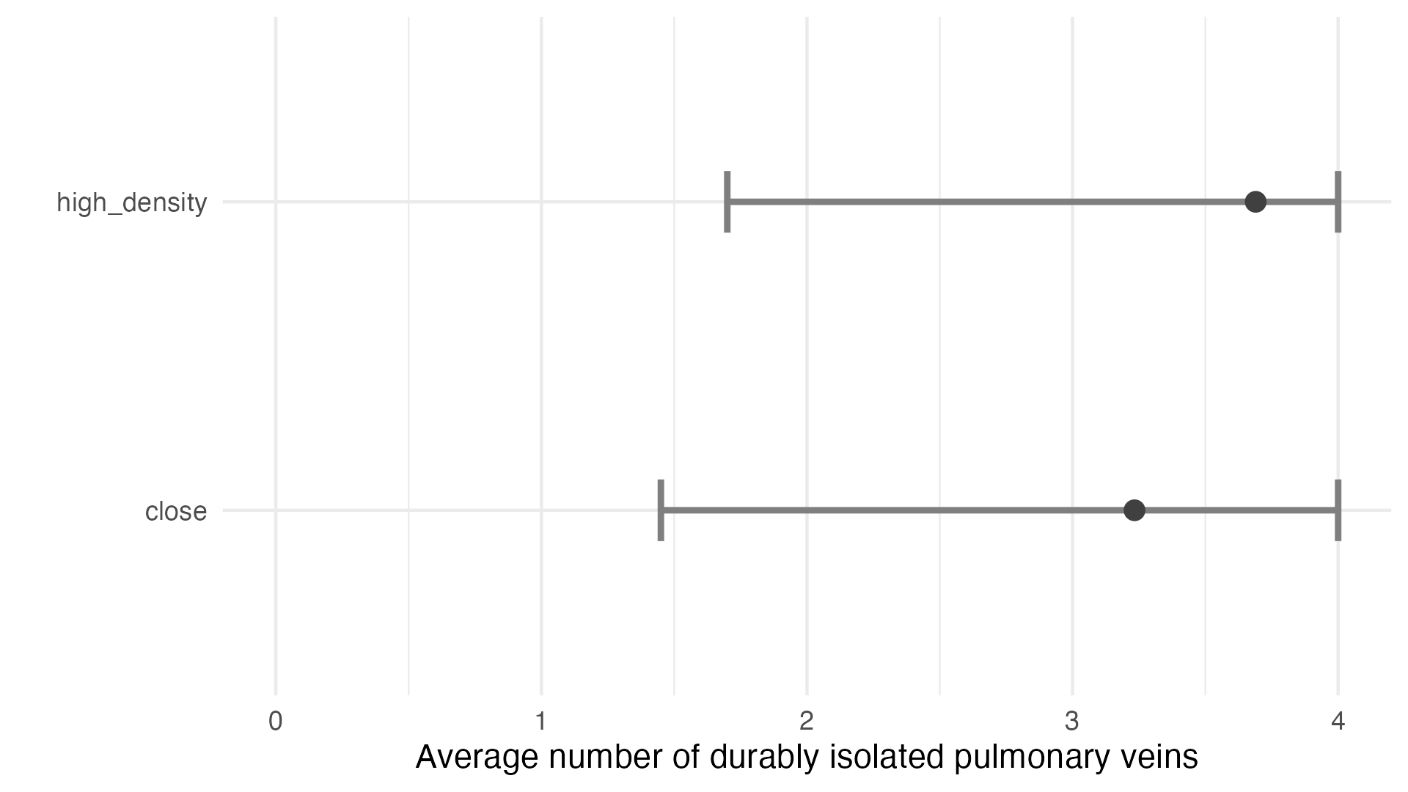
**5. Time of the second operation**

|  |  |  |
| --- | --- | --- |
| **close** | **high\_density** | **p** |
| 415.08 [389.88, 440.54] | 386.76 [349.76, 421.1] | 0.09 |

**6. Number of isolated veins**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **close** | **high density** | **p** |
| **number of isolated veins** | 3.23 [2.87, 3.53] | 3.69 [3.41, 3.9] | **0.01** |
| **percentage of isolated veins** | 80.83% [72.5%, 88.33%] | 92.24% [85.34%, 97.41%] | **0.02** |
| **all four veins isolated** | 46.67% [30%, 63.33%] | 79.31% [62.07%, 93.1%] | **0.02** |

**Fig 1:**

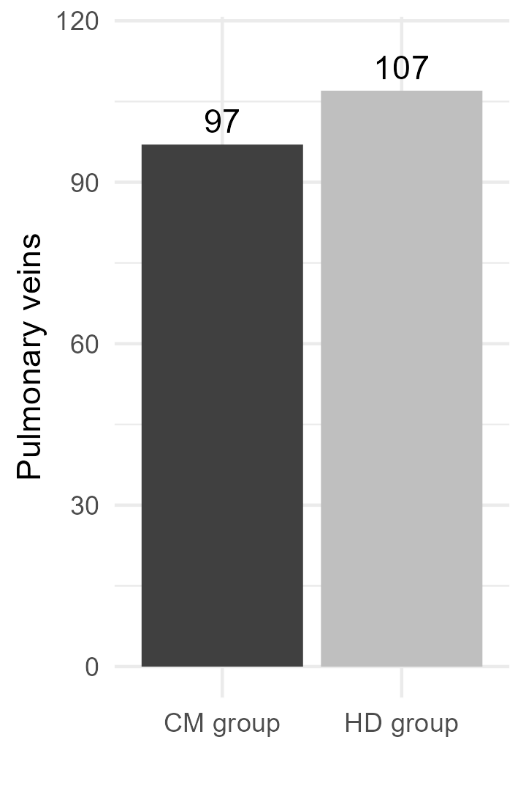


**Fig 2:**

A graph of a number of blood vessels

Description automatically generated

**Fig 3:**

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**7. Time and number of lesions**

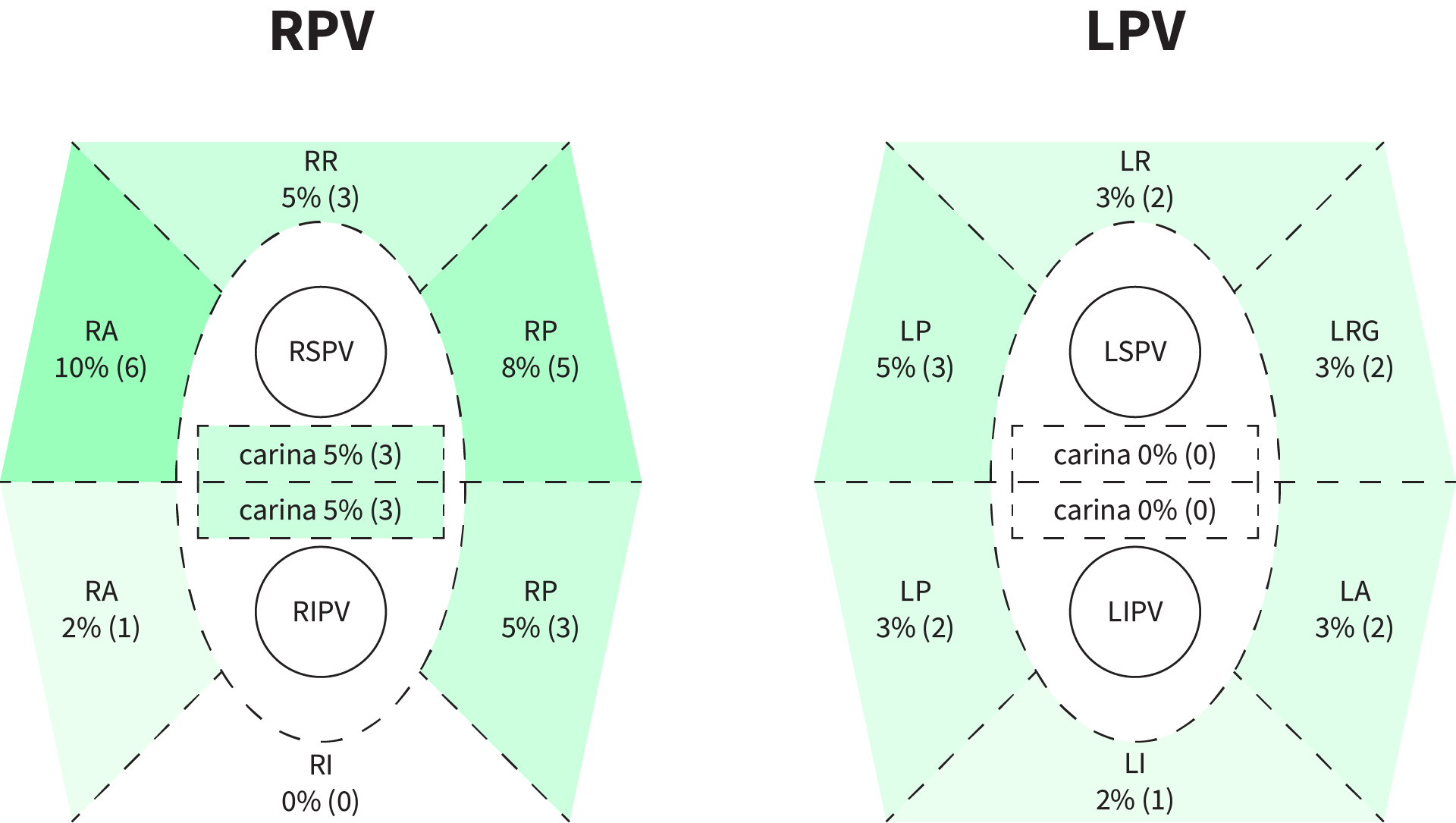
|  |  |  |  |
| --- | --- | --- | --- |
|  | **close** | **high density** | **p** |
| **skin\_skin\_time2** | 83.97 [73.2, 95.33] | 72.04 [60.89, 83.82] | 0.15 |
| **ablate\_reisolization\_time** | 3.63 [2.45, 5.1] | 3.52 [1.93, 4.97] | 0.79 |
| **ablate\_removal\_time\_dormant** | 3.27 [2.55, 4.17] | 4 [2.6, 5.59] | 0.84 |
| **rf\_lesion\_number\_isolation** | 13.5 [10.25, 16.88] | 10.5 [6.33, 14.67] | 0.39 |
| **rf\_lesion\_number\_gap** | 13.59 [10.68, 16.77] | 10.14 [6.14, 14.43] | 0.32 |

**8. Incidence of unisolated**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **location** | | **close %** | **close** | **high\_density %** | **high\_density** | **p** |
| **RPV** | **rspv\_rr** | 10% [0%, 20%] | 3 [0, 7] | 0% | 0 | 0.25 |
|  | **rspv\_ra** | 13.33% [3.33%, 26.67%] | 4 [1, 8] | 6.9% [0%, 17.24%] | 2 [0, 5] | 0.7 |
|  | **rspv\_rp** | 10% [0%, 20%] | 3 [0, 7] | 6.9% [0%, 17.24%] | 2 [0, 5] | 1 |
|  | **carina** | 10% [0%, 20%] | 3 [0, 7] | 0% | 0 | 0.25 |
|  |  |  |  |  |  |  |
|  | **ripv\_ra** | 3.33% [0%, 10%] | 1 [0, 3] | 0% | 0 | 1 |
|  | **ripv\_rp** | 10% [0%, 20%] | 3 [0, 7] | 0% | 0 | 0.25 |
|  | **ripv\_ri** | 0% | 0 | 0% | 0 | 1 |
|  | **carina** | 10% [0%, 20%] | 3 [0, 7] | 0% | 0 | 0.25 |
|  |  |  |  |  |  |  |
| **LPV** | **lspv\_lr** | 3.33% [0%, 10%] | 1 [0, 3] | 3.45% [0%, 10.34%] | 1 [0, 3] | 1 |
|  | **lspv\_lrg** | 3.33% [0%, 10%] | 1 [0, 3] | 3.45% [0%, 10.34%] | 1 [0, 3] | 1 |
|  | **lspv\_lp** | 6.67% [0%, 16.67%] | 2 [0, 5] | 3.45% [0%, 10.34%] | 1 [0, 3] | 1 |
|  | **carina** | 0% | 0 | 0% | 0 | 1 |
|  |  |  |  |  |  |  |
|  | **lipv\_la** | 6.67% [0%, 16.67%] | 2 [0, 5] | 0% | 0 | 0.49 |
|  | **lipv\_li** | 0% | 0 | 3.45% [0%, 10.34%] | 1 [0, 3] | 0.99 |
|  | **lipv\_lp** | 3.33% [0%, 10%] | 1 [0, 3] | 3.45% [0%, 10.34%] | 1 [0, 3] | 1 |
|  | **carina** | 0% | 0 | 0% | 0 | 1 |

Group comparison over veins:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **vein** | **close %** | **close** | **high\_density %** | **high\_density** | **p** |
| **rspv** | 10.83% [5.83%, 16.67%] | 13 [7, 20] | 3.45% [0.86%, 6.9%] | 4 [1, 8] | **0.05** |
| **ripv** | 5.83% [1.67%, 10%] | 7 [2, 12] | 0% | 0 | **0.02** |
| **lspv** | 3.33% [0.83%, 6.67%] | 4 [1, 8] | 2.59% [0%, 6.03%] | 3 [0, 7] | 1 |
| **lipv** | 2.5% [0%, 5.83%] | 3 [0, 7] | 1.72% [0%, 4.31%] | 2 [0, 5] | 1 |

****

**9. Dormant conduction**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **location** | | **close** | **high\_density** | **p** |
| **RPV** | **rspv\_rr** | 6 [2, 11] | 1 [0, 3] | **0.047** |
|  | **rspv\_ra** | 3 [0, 7] | 2 [0, 5] | 0.65 |
|  | **rspv\_rp** | 4 [1, 8] | 1 [0, 3] | 0.17 |
|  |  |  |  |  |
|  | **ripv\_ra** | 0 | 0 | 1 |
|  | **ripv\_rp** | 4 [1, 8] | 2 [0, 5] | 0.4 |
|  | **ripv\_ri** | 0 | 0 | 1 |
|  |  |  |  |  |
|  |  |  |  |  |
| **LPV** | **lspv\_lr** | 1 [0, 3] | 0 | 0.33 |
|  | **lspv\_lrg** | 5 [1, 9] | 1 [0, 3] | 0.09 |
|  | **lspv\_lp** | 4 [0, 9] | 0 | 0.08 |
|  |  |  |  |  |
|  | **lipv\_la** | 4 [1, 8] | 0 | **0.04** |
|  | **lipv\_li** | 0 | 0 | 1 |
|  | **lipv\_lp** | 3 [0, 6] | 0 | 0.08 |

Group comparison across all locations:

|  |  |  |
| --- | --- | --- |
| **close** | **high\_density** | **p** |
| 34 [24, 44] | 7 [3, 12] | **0.00002** |

Group comparison across veins:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **location** | | **close** | **high\_density** | **p** |
| **rspv** | | 13 [7, 20] | 4 [1, 8] | **0.02** |
|  | **ripv** | 4 [1, 8] | 2 [0, 5] | 0.41 |
|  | **lspv** | 10 [4, 17] | 1 [0, 3] | **0.01** |
|  | **lipv** | 7 [3, 13] | 0 | **0.01** |

**A group of blue shapes with black text

Description automatically generated**

**10. Clinical recidiv**

Number/percentage of recidivs:

|  |  |  |  |
| --- | --- | --- | --- |
|  | **close** | **high density** | **p** |
| **number of recidivs** | 10 [5, 15] | 7 [3, 12] | 0.44 |
| **percentage of recidivs** | 33.33% [16.67%, 50%] | 24.14% [10.34%, 41.38%] | 0.62 |

Difference between the operation and recidiv in days:

|  |  |  |
| --- | --- | --- |
| **close** | **high\_density** | **p** |
| 224.6 [168.3, 286.3] | 149.29 [107.57, 200.71] | **0.04** |
|  |  |  |

A graph showing a line

Description automatically generated

*A graph of a number of groups

Description automatically generated with medium confidence*

*Did patents with recidiv have more reconnected veins on average then those without?*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **recidiv** | **no\_recidiv** | **p** |
| **number of reconnected veins** | 0.76 [0.24, 1.41] | 0.45 [0.29, 0.64] | 0.76 |

*Did patents with recidive have more dormants on average then those without?*

|  |  |  |  |
| --- | --- | --- | --- |
|  | **recidiv** | **no\_recidiv** | **p** |
| **dormants** | 0.06 [0.03, 0.1] | 0.06 [0.04, 0.08] | 0.65 |

**11. Location after/before**

**a.**

*In total the high density procedure was used on 29 patients, since each patient has 12 vein locations this means that the high density procedure could be applied to 348 locations in total. During the first procedure, we found 1 or more dormants at a given location in 34 cases, while we found only 7 dormant locations during the second procedure. In only one case the dormant in the second procedure was found at the same location as during the first procedure, while in 33 cases where there was a dormant during the first procedure at a given location there was no dormant during the second procedure at the same location. Thus, our results suggest that it is more likely that there will be no dormant on the same location during the second procedure (p < 0.0001).*

**b.**

*In total the high density procedure was used on 29 patients, since each patient has 4 main pulmonary veins this means that the high density procedure could be applied to 116 main pulmonary veins in total. During the first procedure, we found 1 or more dormants at a given main pulmonary vein in 30 cases, while we found only 7 dormants in total during the second procedure. In only one case the dormant in the second procedure was found at the same main pulmonary vein as during the first procedure while in 29 cases where there was a dormant during the first procedure in a given main pulmonary vein there was no dormant during the second procedure at the same vein. This means that our results suggest that it is more likely that there will be no dormant on the same location during the second procedure (p < 0.0001).*

**c.**

*Same analysis as* ***b****, but we are looking at dormants and their veins during the index (first) procedure and dormants + unisolated veins during the second procedure. We have 30 veins with dormants in the first procedure and 16 veins with dormants or unisolated veins in the second procedure. In 4 cases we have a dormant or an unisolated vein at the main pulmonary vein where we found a dormant during the first procedure, while there was no dormant or unisolated veins in 26 cases when there was a dormant during the first procedure. Again, this suggests that finding a dormant in a given main pulmonary vein during the first procedure does not indicate that we will have a dormant or unisolated veins in the same main pulmonary vein during the second procedure (0.0001).*

**12. Reconnected veins**

Do demographics predict reconnected veins. We are looking at the column all 4 veins, 0 means that it was reconnected. I was looking over all the data here, I didn't break anything down into groups.

I used the following demographic variables:

* age,
* gender,
* bmi,
* la\_volume\_index,
* la\_size,
* lvedvi,
* anticoagulant,
* probnp,
* chf,
* hypertension\_history,
* age\_75,
* diabetes\_history,
* vascular\_disease,
* age\_65\_74,
* cha2ds2vasc.

We don't get anything, BMI has the lowest p value (0.098).

Same for procedural parameters only:

* skin\_skin\_time,
* la\_dwell\_time,
* ablation\_time,
* number\_of\_rf\_lesions\_pvi,
* first\_pass\_rspv,
* first\_pass\_ripv,
* first\_pass\_lspv,
* first\_pass\_lipv,
* first\_pass\_per\_patient,
* all\_4\_veins\_isolated.

Nothing, p for all parameters is above 0.2.