**Supplemental Table 1: Changes of echocardiographic parameters during hospitalization in patients with AHF and non-cardiac dyspnea:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | AHF | Non-cardiac dyspnea | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Cardiac geometry |  |  |  |  |  |  |  |  |  |
|  LVEDD (mm) | 30 | 57 [50-67] | 56 [48-65] | 0.48 | 12 | 48 [42-53] | 47 [44-55] | 0.15 | 0.08 |
|  LVESD (mm) | 30 | 43 [33-57] | 41 [30-53] | 0.34 | 12 | 30 [25-37] | 30 [25-43] | 0.15 | 0.06 |
|  LVEDV (ml) | 29 | 120[76-140] | 118[95-176] | 0.23 | 15 | 96[71-114] | 91[73-104] | 0.70 | 0.14 |
|  LVESV (ml) | 26 | 68 [42-108] | 61 [37-124] | 0.63 | 15 | 40 [32-48] | 38 [29-41] | 0.15 | 0.52 |
| Left atrial area (cm2) | 38 | 25 [21-28] | 25 [20-32] | 0.77 | 15 | 18 [14-22] | 20 [18-21] | 0.67 | 0.64 |
| Right atrial area (cm2) | 19 | 18 [16-22] | 17 [16-23] | 0.36 | 7 | 16 [13-17] | 13 [12-16] | 0.74 | 0.31 |
| Cardiac function |  |  |  |  |  |  |  |  |  |
|  LVEF (%) | 41 | 40 [29-50] | 40 [30-56] | 0.72 | 17 | 60 [52-64] | 58 [52-61] | 0.83 | 0.95 |
|  Heart rate (bpm) | 38 | 89 [78-100] | 74 [64-95] | **0.001** | 15 | 90 [79-100] | 76 [71-88] | 0.16 | 0.99 |
|  Stroke volume (mL) | 27 | 41 [30-58] | 48 [36-59] | 0.44 | 16 | 55 [38-66] | 50 [37-65] | 0.98 | 0.51 |
|  Cardiac index (mL/min/m2) | 19 | 2.1 [1.6-2.6] | 1.9 [1.4-2.4] | 0.55 | 13 | 2.6 [2.1-3.2] | 2.0 [1.9-2.7] | 0.22 | 0.72 |
|  TAPSE (mm) | 21 | 16 [15-19] | 19 [17-21] | **0.04** | 7 | 20 [19-23] | 18 [17-19] | 0.18 | **0.04** |
|  E wave (cm/s) | 42 | 95 [75-122] | 85 [70-111] | 0.10 | 18 | 81 [56-93] | 79 [55-99] | 0.98 | 0.32 |
|  E wave deceleration time (ms) | 41 | 129[105-156] | 166[128-203] | **0.003** | 18 | 172[152-238] | 213[140-264] | 0.19 | 0.41 |
|  A wave (cm/s) | 24 | 63 [30-92] | 69 [41-89] | 0.60 | 14 | 96 [62-115] | 85 [70-109] | 0.89 | 0.90 |
|  E/A | 22 | 1.70[0.90-2.61] | 1.37[1.12-2.39] | 0.83 | 12 | 0.75[0.63-1.17] | 0.84[0.60-1.04] | 0.75 | 0.56 |
|  Medial e’ | 34 | 4 [3-5] | 5 [4-7] | **0.003** | 18 | 6 [5-7] | 7 [5-8] | 0.94 | **0.03** |
|  Lateral e’ | 39 | 7 [5-8] | 7 [5-8] | 0.71 | 18 | 8 [6-11] | 7 [6-9] | 0.10 | 0.43 |
|  Medial E/e’ | 42 | 21.1[15.8-29.6] | 16.6[11.7-24.3] | **0.004** | 21 | 11.5[8.8-16.0] | 11.9[11.0-15.0] | 0.34 | **0.003** |
|  Lateral E/e’ | 48 | 14.3[11.4-18.4] | 13.7[9.2-18.2] | 0.98 | 23 | 9.2[7.0-10.8] | 9.8[8.2-12.6] | 0.05 | 0.12 |
|  Mean E/e’ | 39 | 18.7[13.7-23.9] | 17.4[10.7-20.9] | 0.05 | 20 | 10.4[7.9-13.1] | 10.9[9.5-13.3] | 0.09 | **0.01** |
| Parameters of venous congestion |  |  |  |  |  |  |  |  |  |
| IVC rest diameter (mm) | 23 | 22 [16-24] | 13 [11-18] | **0.009** | 13 | 18 [11-20] | 16 [11-20] | 0.58 | 0.10 |
| IVC sniff diameter (mm) | 21 | 16 [9-22] | 7 [4-11] | **0.002** | 12 | 6 [5-14] | 6 [0-13] | 0.39 | 0.38 |
|  Respiratory variability of IVC diameter (%) | 21 | 32 [8-44] | 43 [29-70] | **0.04** | 12 | 55 [39-62] | 52 [38-100] | 0.42 | 0.43 |

Data are presented as median [interquartile range].

AHF: acute heart failure, IVC: inferior vena cava, LVEDD: left ventricular end-diastolic diameter, LVEDV: left ventricular end-diastolic volume, LVEF: left ventricular ejection fraction, LVESD: left ventricular end-systolic diameter, LVESV: left ventricular end-systolic volume, TAPSE: tricuspid annular plane systolic excursion.

**Supplemental Table 2: Changes of echocardiographic parameters during hospitalization in patients with acute HFPEF (LVEF≥50%) and HFREF (LVEF<40%):**

|  |  |  |  |
| --- | --- | --- | --- |
|  | HFPEF (LVEF≥50%) | HFREF (LVEF<40%) | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Cardiac geometry |  |  |  |  |  |  |  |  |  |
|  LVEDD (mm) | 10 | 49 [43-55] | 48 [42-57] | 0.96 | 14 | 68 [61-72] | 66 [61-71] | 0.21 | 0.59 |
|  LVESD (mm) | 10 | 33 [25-43] | 31 [28-40] | 0.78 | 14 | 56 [48-61] | 55 [44-59] | 0.16 | 0.47 |
|  LVEDV (ml) | 9 | 69[67-100] | 108[68-118] | 0.09 | 15 | 138[131-173] | 171[147-183] | 0.51 | 0.60 |
|  LVESV (ml) | 8 | 37[28-47] | 60[50-62] | 0.48 | 13 | 108[78-126] | 124[75-147] | 0.62 | 0.50 |
| Left atrial area (cm2) | 14 | 21 [16-25] | 24 [19-27] | 0.27 | 15 | 27 [25-34] | 29 [24-34] | 0.98 | 0.29 |
| Right atrial area (cm2) | 4 | 17 [12-19] | 17 [16-18] | 0.27 | 11 | 18 [17-23] | 22 [17-27] | 0.48 | 0.66 |
| Cardiac function |  |  |  |  |  |  |  |  |  |
|  LVEF (%) | 13 | 60 [50-64] | 58 [56-64] | 0.60 | 18 | 30 [25-36] | 29 [23-32] | 0.24 | 0.23 |
|  Heart rate (bpm) | 13 | 81 [80-95] | 80 [72-96] | 0.33 | 16 | 96 [88-110] | 75 [62-95] | **0.01** | 0.29 |
|  Stroke volume (mL) | 8 | 34 [29-42] | 52 [34-72] | 0.07 | 13 | 52 [36-61] | 45 [35-58] | 0.75 | 0.24 |
|  Cardiac index (mL/min/m2) | 6 | 1.6 [1.4-1.6] | 2.1 [1.3-3.7] | 0.35 | 9 | 2.5 [2.1-3.3] | 1.9 [1.4-2.4] | 0.21 | 0.09 |
|  TAPSE (mm) | 7 | 17 [16-22] | 17 [17-19] | 1.00 | 10 | 16 [15-18] | 19 [18-25] | 0.06 | 0.36 |
|  E wave (cm/s) | 14 | 102[85-111] | 83[73-119] | 0.32 | 18 | 91[70-131] | 89[74-111] | 0.83 | 0.38 |
|  E wave deceleration time (ms) | 13 | 155[138-175] | 180[128-226] | 0.46 | 19 | 121[102-139] | 159[127-179] | **0.008** | 0.29 |
|  A wave (cm/s) | 8 | 92 [64-122] | 79 [48-135] | 0.33 | 11 | 31 [25-62] | 46 [32-67] | 0.35 | 0.13 |
|  E/A | 7 | 1.15[0.74-1.61] | 1.36[1.02-1.94] | 0.23 | 10 | 2.15[1.50-2.81] | 2.17[1.26-2.69] | 0.33 | 0.13 |
|  Medial e’ | 13 | 4 [4-6] | 5 [4-7] | 0.16 | 12 | 4 [3-4] | 5 [4-6] | **0.007** | 0.41 |
|  Lateral e’ | 13 | 7 [6-9] | 6 [4-8] | 0.19 | 17 | 7 [5-8] | 8 [5-11] | 0.53 | 0.43 |
|  Medial E/e’ | 16 | 25.0[17.4-35.4] | 15.2[11.0-24.8] | **0.02** | 17 | 21.0[14.0-25.5] | 19.2[12.0-22.0] | 0.20 | 0.26 |
|  Lateral E/e’ | 17 | 15.8[13.8-18.1] | 16.4[9.4-20.5] | 0.49 | 22 | 13.0[8.8-16.0] | 13.4[8.8-19.0] | 0.71 | 0.79 |
|  Mean E/e’ | 15 | 19.8[16.1-30.1] | 18.0[11.3-20.9] | 0.31 | 16 | 18.0[11.3-21.5] | 18.0[10.6-23.5] | 0.44 | 0.68 |
| Parameters of venous congestion |  |  |  |  |  |  |  |  |  |
| IVC rest diameter (mm) | 6 | 22 [16-23] | 18 [17-22] | 0.67 | 12 | 22 [18-25] | 14 [12-20] | **0.04** | 0.39 |
| IVC sniff diameter (mm) | 6 | 11 [9-22] | 11 [6-13] | 0.35 | 10 | 19 [10-24] | 7 [0-13] | **0.03** | 0.31 |
|  Respiratory variability of IVC diameter (%) | 6 | 42 [14-45] | 40 [29-41] | 0.92 | 10 | 24 [8-43] | 50 [23-100] | 0.11 | 0.37 |

Data are presented as median [interquartile range].

AHF: acute heart failure, IVC: inferior vena cava, LVEDD: left ventricular end-diastolic diameter, LVEDV: left ventricular end-diastolic volume, LVEF: left ventricular ejection fraction, LVESD: left ventricular end-systolic diameter, LVESV: left ventricular end-systolic volume, TAPSE: tricuspid annular plane systolic excursion.

**Supplemental Table 3: Changes of echocardiographic parameters during hospitalization in AHF patients according to below or above median value of total IV furosemide dose:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Total IV furosemide > 280mg | Total IV furosemide ≤ 280mg | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Cardiac geometry |  |  |  |  |  |  |  |  |  |
|  LVEDD (mm) | 13 | 54 [46-63] | 53 [43-61] | 1.00 | 11 | 60 [53-71] | 60 [53-65] | 0.18 | 0.33 |
|  LVESD (mm) | 13 | 39 [25-45] | 31 [28-48] | 0.92 | 11 | 48 [40-59] | 44 [40-55] | **0.04** | 0.13 |
|  LVEDV (ml) | 12 | 107[69-135] | 105[77-176] | 0.15 | 12 | 131[100-162] | 133[105-175] | 0.91 | 0.63 |
|  LVESV (ml) | 10 | 50[36-78] | 43[26-68] | 0.52 | 12 | 71[57-118] | 82[49-126] | 0.39 | 0.12 |
| Left atrial area (cm2) | 17 | 26 [22-28] | 27 [22-32] | 0.92 | 15 | 23 [21-28] | 23 [18-27] | 0.21 | 0.35 |
| Right atrial area (cm2) | 8 | 16 [14-20] | 18 [17-21] | 0.16 | 5 | 18 [18-24] | 16 [15-23] | 0.50 | 0.35 |
| Cardiac function |  |  |  |  |  |  |  |  |  |
|  Heart rate (bpm) | 16 | 84 [72-106] | 76 [67-92] | 0.11 | 15 | 95 [83-98] | 67 [63-76] | **0.002** | 0.13 |
|  LVEF (%) | 17 | 40 [31-50] | 41 [30-62] | 0.78 | 18 | 39 [30-59] | 40 [28-54] | 0.86 | 0.83 |
|  Stroke volume (mL) | 10 | 34 [28-43] | 41 [27-50] | 0.33 | 13 | 58 [35-61] | 50 [37-58] | 0.68 | 0.52 |
|  Cardiac index (mL/min/m2) | 8 | 1.8 [1.6-2.3] | 1.7 [1.4-3.1] | 0.78 | 8 | 2.6 [2.2-3.4] | 1.8 [1.4-2.4] | **0.04** | 0.07 |
|  TAPSE (mm) | 7 | 19 [14-23] | 19 [18-23] | 0.55 | 10 | 16 [15-18] | 19 [17-21] | **0.03** | 0.74 |
|  E wave (cm/s) | 17 | 102 [70-142] | 82 [74-111] | 0.12 | 18 | 93 [80-111] | 84 [67-109] | 0.16 | 0.86 |
|  E wave deceleration time (ms) | 17 | 140[115-187] | 174[146-220] | 0.14 | 17 | 121[103-151] | 161[128-209] | **0.01** | 0.21 |
|  A wave (cm/s) | 8 | 89 [30-97] | 80 [61-101] | 1.00 | 12 | 55 [30-82] | 67 [41-77] | 0.48 | 0.91 |
|  E/A | 8 | 1.33[0.79-2.42] | 1.33[0.99-1.75] | 1.00 | 10 | 1.91[1.30-2.06] | 1.36[1.12-2.32] | 0.72 | 0.70 |
|  Medial e’ | 13 | 4 [4-5] | 6 [4-7] | 0.23 | 16 | 4 [3-5] | 6 [5-7] | **0.001** | 0.05 |
|  Lateral e’ | 15 | 7 [6-9] | 7 [5-10] | 0.97 | 17 | 7 [5-9] | 7 [5-8] | 0.30 | 0.68 |
|  Medial E/e’ | 17 | 18.5[16.0-30.5] | 17.4[12.0-29.5] | 0.44 | 20 | 22.3[14.5-29.5] | 12.5[10.0-20.9] | **0.001** | **0.02** |
|  Lateral E/e’ | 20 | 14.8[11.3-22.5] | 13.4[9.5-18.2] | 0.85 | 21 | 12.8[11.3-15.9] | 13.0[9.4-18.0] | 0.59 | 0.74 |
|  Mean E/e’ | 16 | 18.7[12.6-31.2] | 18.2[11.9-24.0] | 0.57 | 18 | 18.9[16.5-21.8] | 12.4[10.1-20.0] | **0.01** | 0.13 |
| Parameters of venous congestion |  |  |  |  |  |  |  |  |  |
| IVC rest diameter (mm) | 9 | 22 [16-25] | 13 [13-18] | 0.21 | 12 | 22 [16-24] | 13 [11-18] | **0.03** | 0.51 |
| IVC sniff diameter (mm) | 7 | 17 [13-22] | 6 [2-9] | **0.04** | 12 | 11 [9-23] | 7 [2-11] | **0.03** | 0.48 |
|  Respiratory variability of IVC diameter (%) | 7 | 32 [9-38] | 49 [35-80] | 0.06 | 12 | 43 [4-51] | 47 [36-85] | 0.14 | 0.77 |

Data are presented as median [interquartile range].

HFREF: heart failure with reduced left ventricular ejection fraction, HFPEF: heart failure with preserved left ventricular ejection fraction, IVC: inferior vena cava, LVEDD: left ventricular end-diastolic diameter, LVEDV: left ventricular end-diastolic volume, LVEF: left ventricular ejection fraction, LVESD: left ventricular end-systolic diameter, LVESV: left ventricular end-systolic volume, TAPSE: tricuspid annular plane systolic excursion.

**Supplemental Table 4: Changes of echocardiographic parameters during hospitalization in AHF patients receiving IV furosemide alone or IV furosemide plus vasodilators:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | IV furosemide alone | IV furosemide plus vasodilators | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Cardiac geometry |  |  |  |  |  |  |  |  |  |
|  LVEDD (mm) | 18 | 59 [50-69] | 61 [50-67] | 0.60 | 6 | 55 [52-70] | 58 [49-63] | 0.53 | 0.54 |
|  LVESD (mm) | 18 | 43 [33-60] | 45 [28-57] | 0.95 | 6 | 43 [37-54] | 42 [31-47] | 0.27 | 0.38 |
|  LVEDV (ml) | 15 | 132[99-147] | 160[105-187] | 0.33 | 9 | 100[99-120] | 110[80-118] | 0.59 | 0.91 |
|  LVESV (ml) | 12 | 85 [50-134] | 92 [43-139] | 0.86 | 9 | 62 [42-68] | 51 [43-75] | 0.95 | 0.70 |
| Left atrial area (cm2) | 22 | 26 [22-29] | 27 [21-32] | 0.77 | 9 | 22 [20-25] | 23 [22-27] | 0.72 | 0.65 |
| Right atrial area (cm2) | 11 | 20 [16-23] | 19 [17-23] | 0.76 | 5 | 18 [18-18] | 16 [15-17] | 0.89 | 0.91 |
| Cardiac function |  |  |  |  |  |  |  |  |  |
|  LVEF (%) | 23 | 34 [28-45] | 35 [30-45] | 0.31 | 11 | 46 [33-60] | 50 [40-55] | 0.59 | 0.27 |
|  Heart rate (bpm) | 23 | 97 [79-116] | 74 [65-92] | **0.004** | 9 | 81 [72-87] | 70 [64-81] | **0.04** | 0.48 |
|  Stroke volume (mL) | 13 | 43 [33-61] | 45 [36-56] | 1.00 | 9 | 35 [30-58] | 37 [36-66] | 0.44 | 0.74 |
|  Cardiac index (mL/min/m2) | 10 | 2.3 [2.0-3.6] | 1.8 [1.4-2.4] | 0.29 | 5 | 2.2 [1.4-2.3] | 1.8 [1.5-2.4] | 0.89 | 0.44 |
|  TAPSE (mm) | 11 | 16 [14-19] | 19 [18-23] | 0.16 | 6 | 17 [15-20] | 17 [15-19] | 0.72 | 0.59 |
|  E wave (cm/s) | 26 | 98 [79-131] | 83 [67-100] | **0.006** | 10 | 98 [85-111] | 94 [82-119] | 0.65 | 0.11 |
|  E wave deceleration time (ms) | 25 | 129[104-157] | 161[133-181] | **0.004** | 10 | 126[107-151] | 167[123-187] | 0.11 | 0.76 |
|  A wave (cm/s) | 13 | 56 [26-90] | 63 [46-88] | 0.78 | 7 | 68 [55-108] | 73 [39-120] | 0.80 | 0.39 |
|  E/A | 11 | 2.23[1.03-2.87] | 1.45[1.02-2.17] | 0.18 | 7 | 1.92[1.34-2.03] | 1.36[1.24-2.36] | 0.87 | 0.48 |
|  Medial e’ | 21 | 4 [4-6] | 5 [4-7] | **0.04** | 10 | 4 [3-4] | 5 [4-6] | 0.09 | 0.23 |
|  Lateral e’ | 23 | 7 [5-8] | 7 [5-8] | 0.79 | 10 | 7 [6-8] | 7 [5-9] | 0.86 | 0.92 |
|  Medial E/e’ | 22 | 20.6[15.8-30.5] | 15.4[10.0-25.0] | **0.007** | 13 | 23.8[21.3-29.6] | 16.8[12.3-21.8] | 0.12 | 0.78 |
|  Lateral E/e’ | 24 | 14.8[12.3-20.5] | 11.9[8.5-18.4] | 0.30 | 13 | 14.4[11.4-16.0] | 14.4[9.0-18.0] | 0.97 | 0.48 |
|  Mean E/e’ | 20 | 18.5[15.1-31.2] | 16.9[10.0-22.2] | **0.007** | 12 | 20.1[15.1-23.7] | 16.8[12.0-20.1] | 0.39 | 0.58 |
| Parameters of venous congestion |  |  |  |  |  |  |  |  |  |
| IVC rest diameter (mm) | 16 | 23 [20-24] | 13 [11-18] | **0.004** | 4 | 18 [16-23] | 16 [12-18] | 0.11 | 0.39 |
| IVC sniff diameter (mm) | 14 | 22 [11-24] | 6 [0-11] | **0.002** | 4 | 10 [6-14] | 7 [3-9] | 0.59 | 0.23 |
|  Respiratory variability of IVC diameter (%) | 14 | 14 [0-40] | 50 [23-100] | **0.006** | 4 | 48 [39-65] | 46 [36-77] | 0.72 | 0.06 |

Data are presented as median [interquartile range].

AHF: acute heart failure, IVC: inferior vena cava, LVEDD: left ventricular end-diastolic diameter, LVEDV: left ventricular end-diastolic volume, LVEF: left ventricular ejection fraction, LVESD: left ventricular end-systolic diameter, LVESV: left ventricular end-systolic volume, TAPSE: tricuspid annular plane systolic excursion.

**Supplemental Table 5: Changes of biomarkers during hospitalization in patients with AHF and non-cardiac dyspnea:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | AHF | Non-cardiac dyspnea | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Markers of cardiovascular stress and congestion: |  |  |  |  |  |  |  |  |  |
| BNP (pg/mL) | 38 | 935[514-2037] | 308[183-609] | **<0.001** | 11 | 237[110-257] | 57[35-166] | **0.03** | 0.17 |
|  MR-proANP (pmol/L) | 59 | 449[274-653] | 366[242-549] | **<0.001** | 24 | 164[89-288] | 140[71-296] | 0.83 | 0.15 |
|  sCD146 (ng/mL) | 58 | 528[406-654] | 450[374-529] | **0.003** | 24 | 306[209-428] | 325[262-535] | 0.39 | **0.01** |
|  hsTnI (pg/mL) | 54 | 36 [18-87] | 22 [11-66] | **0.02** | 24 | 12 [6-145] | 9 [5-16] | **0.04** | 0.81 |
| Markers of inflammation and fibrosis |  |  |  |  |  |  |  |  |  |
|  Soluble ST2 (ng/mL) | 59 | 83 [61-132] | 42 [36-59] | **<0.001** | 24 | 69 [54-106] | 49 [38-61] | **0.02** | 0.06 |
|  CRP (mg/L) | 58 | 9.9[4.2-32.3] | 8.3[3.5-34.4] | 0.36 | 24 | 33.3[14.0-126.9] | 24.8[7.5-53.4] | **0.04** | 0.08 |
|  Procalcitonin (ng/mL) | 56 | 0.10[0.08-0.14] | 0.11[0.07-0.14] | 0.37 | 22 | 0.12[0.06-0.36] | 0.08[0.05-0.18] | 0.22 | 0.54 |
| Biological markers of renal function: |  |  |  |  |  |  |  |  |  |
|  Creatinine (mg/dL) | 59 | 1.18[0.90-1.53] | 1.19[0.86-1.70] | 0.89 | 24 | 0.92[0.75-1.07] | 0.85[0.71-1.03] | 0.10 | **0.006** |
|  eGFR (mL/min/1.73m2) | 59 | 59 [40-75] | 56 [38-73] | 0.09 | 24 | 79 [57-86] | 82 [64-100] | **0.03** | **0.006** |
|  Cystatin C (mg/L) | 57 | 1.50[1.20-2.27] | 1.78[1.33-2.59] | **<0.001** | 23 | 1.45[1.21-2.14] | 1.43[1.05-1.86] | **0.04** | **<0.001** |
|  Urea nitrogen (mmol/L) | 57 | 8.9[6.9-13.2] | 10.2[7.6-16.0] | **0.006** | 23 | 7.0[5.3-10.4] | 6.5[5.2-9.3] | 0.29 | **0.006** |
|  Uric acid (µmol/L) | 57 | 407[348-551] | 478[357-545] | **0.006** | 23 | 336[290-401] | 315[255-381] | 0.52 | **0.02** |
|  NGAL (ng/mL) | 54 | 127[95-260] | 167[104-263] | **0.004** | 20 | 125[82-260] | 139[84-227] | 0.82 | 0.31 |
| Markers of plasma volume: |  |  |  |  |  |  |  |  |  |
|  Hemoglobin (g/dL) | 53 | 12.9[11.5-13.9] | 12.3[11.1-13.4] | **0.02** | 20 | 12.7[11.2-14.3] | 12.2[10.4-12.8] | **0.004** | **0.04** |
|  Hematocrit (%) | 53 | 39 [36-42] | 38 [34-41] | **0.02** | 20 | 39 [33-44] | 37 [31-39] | **0.007** | 0.11 |
|  Estimated plasma volume | 53 | 4.8 [4.2-5.6] | 5.1 [4.4-5.8] | **0.03** | 20 | 4.9 [3.9-6.0] | 5.1 [4.8-6.6] | **0.01** | 0.06 |

Data are presented as median [interquartile range]

AHF: acute heart failure, BNP: B-type natriuretic peptide, CRP: C-reactive protein, eGFR: estimated glomerular filtration rate, hsTnI: high sensitive troponin I, MR-proANP: mid-regional pro-atrial natriuretic peptide, NGAL: neutrophil gelatinase associated lipocalin, sCD146: soluble cluster of differentiation 146, ST-2: suppression of tumorigenecity-2.

**Supplemental Table 6: Changes of biomarkers during hospitalization in patients with acute HFPEF (LVEF≥50%) and HFREF (LVEF<40%):**

|  |  |  |  |
| --- | --- | --- | --- |
|  | HFPEF (LVEF≥50%) | HFREF (LVEF<40%) | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Markers of cardiovascular stress and congestion: |  |  |  |  |  |  |  |  |  |
| BNP (pg/mL) | 11 | 848[414-1491] | 228[198-520] | **0.003** | 19 | 989[901-3039] | 313[194-598] | **<0.001** | 0.67 |
|  MR-proANP (pmol/L) | 21 | 380[267-631] | 382[238-537] | 0.16 | 25 | 515[305-737] | 376[254-587] | **0.003** | 0.34 |
|  sCD146 (ng/mL) | 21 | 500[379-554] | 439[338-515] | 0.06 | 24 | 606[448-705] | 483[423-590] | 0.12 | 0.87 |
|  hsTnI (pg/mL) | 21 | 26 [16-87] | 13 [10-31] | **0.005** | 20 | 45 [21-111] | 31 [15-89] | 0.20 | 0.40 |
| Markers of inflammation and fibrosis |  |  |  |  |  |  |  |  |  |
|  Soluble ST2 (ng/mL) | 21 | 82 [57-122] | 45 [40-54] | **<0.001** | 25 | 89 [59-133] | 41 [33-53] | **<0.001** | 0.42 |
|  CRP (mg/L) | 21 | 11.8[3.9-34.3] | 9.6[6.4-13.7] | 0.29 | 24 | 8.0[3.8-17.9] | 4.0[2.5-27.9] | 0.14 | 0.70 |
|  Procalcitonin (ng/mL) | 21 | 0.12[0.09-0.14] | 0.09[0.08-0.12] | **0.04** | 24 | 0.10[0.08-0.17] | 0.11[0.07-0.17] | 0.75 | 0.17 |
| Biological markers of renal function: |  |  |  |  |  |  |  |  |  |
|  Creatinine (mg/dL) | 21 | 1.10[0.92-1.35] | 1.07[0.89-1.68] | 0.19 | 25 | 1.27[1.05-1.60] | 1.34[1.13-1.64] | 0.46 | 0.28 |
|  eGFR (mL/min/1.73m2) | 21 | 59 [40-69] | 55 [36-73] | 0.22 | 25 | 59 [45-76] | 56 [41-68] | 0.41 | 0.28 |
|  Cystatin C (mg/L) | 20 | 1.61[1.28-2.42] | 1.90[1.43-2.80] | **0.003** | 24 | 1.40[1.14-1.83] | 1.49[1.30-1.88] | **0.002** | 0.71 |
|  Urea nitrogen (mmol/L) | 20 | 9.1[7.0-12.7] | 9.8[7.6-16.6] | **0.04** | 24 | 8.5[7.2-14.1] | 10.4[7.9-16.4] | 0.16 | 0.96 |
|  Uric acid (µmol/L) | 20 | 371[324-479] | 472[316-559] | **0.02** | 24 | 449[394-679] | 481[401-635] | 0.95 | 0.09 |
|  NGAL (ng/mL) | 20 | 181[95-286] | 217[105-326] | 0.10 | 22 | 107[85-147] | 132[84-188] | 0.09 | 0.78 |
| Markers of plasma volume: |  |  |  |  |  |  |  |  |  |
|  Hemoglobin (g/dL) | 15 | 11.9[11.4-13.0] | 11.6[11.0-12.2] | 0.09 | 26 | 13.5[12.5-14.4] | 13.1[11.9-13.9] | 0.14 | 0.62 |
|  Hematocrit (%) | 15 | 37 [35-39] | 36 [34-38] | 0.07 | 26 | 41 [38-44] | 39 [37-43] | 0.12 | 0.68 |
|  Estimated plasma volume | 15 | 5.3 [4.7-5.6] | 5.6 [5.1-6.0] | 0.11 | 26 | 4.3 [3.9-4.9] | 4.7 [4.1-5.1] | 0.16 | 0.66 |

Data are presented as median [interquartile range]

AHF: acute heart failure, BNP: B-type natriuretic peptide, CRP: C-reactive protein, eGFR: estimated glomerular filtration rate, hsTnI: high sensitive troponin I, MR-proANP: mid-regional pro-atrial natriuretic peptide, NGAL: neutrophil gelatinase associated lipocalin, sCD146: soluble cluster of differentiation 146, ST-2: suppression of tumorigenecity-2.

**Supplemental Table 7: Changes of biomarkers during hospitalization in AHF patients according to below or above median value of total IV furosemide dose:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | Total IV furosemide > 280mg | Total IV furosemide ≤ 280mg | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Markers of cardiovascular stress and congestion: |  |  |  |  |  |  |  |  |  |
| BNP (pg/mL) | 16 | 930[623-2504] | 347[192-593] | **<0.001** | 14 | 765[431-1320] | 218[75-305] | **0.001** | 0.05 |
|  MR-proANP (pmol/L) | 26 | 416[272-737] | 373[254-509] | 0.08 | 19 | 510[253-700] | 366[227-558] | **<0.001** | 0.26 |
|  sCD146 (ng/mL) | 26 | 513[406-724] | 504[362-589] | 0.09 | 19 | 500[343-584] | 427[349-452] | 0.16 | 0.89 |
|  hsTnI (pg/mL) | 24 | 36 [17-111] | 35 [13-67] | 0.28 | 19 | 26 [17-62] | 16 [9-31] | **0.02** | 0.11 |
| Markers of inflammation and fibrosis |  |  |  |  |  |  |  |  |  |
|  Soluble ST2 (ng/mL) | 26 | 91 [71-143] | 51 [40-74] | **<0.001** | 19 | 61 [50-117] | 39 [34-47] | **<0.001** | 0.98 |
|  CRP (mg/L) | 26 | 11.7[6.7-37.4] | 9.3[4.3-52.3] | 0.58 | 19 | 10.7[4.4-28.9] | 9.6[3.2-33.6] | 0.24 | 0.40 |
|  Procalcitonin (ng/mL) | 25 | 0.10[0.08-0.16] | 0.11[0.06-0.16] | 0.58 | 19 | 0.12[0.08-0.14] | 0.08[0.07-0.14] | 0.87 | 0.75 |
| Biological markers of renal function: |  |  |  |  |  |  |  |  |  |
|  Creatinine (mg/dL) | 26 | 1.06[0.87-1.57] | 1.10[0.81-1.64] | 0.55 | 19 | 1.18[0.98-1.58] | 1.34[0.98-1.81] | 0.07 | 0.31 |
|  eGFR (mL/min/1.73m2) | 26 | 59 [37-76] | 59 [38-74] | 0.42 | 19 | 58 [38-72] | 52 [37-71] | 0.15 | 0.31 |
|  Cystatin C (mg/L) | 26 | 1.47[1.19-2.37] | 1.72[1.35-2.52] | **0.04** | 18 | 1.57[1.23-2.05] | 1.88[1.33-2.59] | **0.002** | 0.45 |
|  Urea nitrogen (mmol/L) | 26 | 9.2[7.1-13.8] | 9.4[6.9-14.2] | 0.24 | 18 | 8.9[6.4-13.2] | 11.4[7.7-17.1] | **0.03** | 0.29 |
|  Uric acid (µmol/L) | 26 | 426[354-593] | 425[322-622] | 0.75 | 18 | 393[348-497] | 471[398-521] | **0.01** | 0.07 |
|  NGAL (ng/mL) | 25 | 139[95-270] | 171[113-249] | 0.07 | 17 | 130[96-240] | 171[102-263] | **0.005** | 0.62 |
| Markers of plasma volume: |  |  |  |  |  |  |  |  |  |
|  Hemoglobin (g/dL) | 23 | 12.4[11.2-13.4] | 12.0[10.9-13.2] | 0.48 | 23 | 13.3[11.8-13.7] | 12.3[11.3-13.4] | 0.08 | 0.52 |
|  Hematocrit (%) | 23 | 37 [35-41] | 38 [33-40] | 0.25 | 23 | 39 [37-42] | 37 [35-42] | 0.11 | 0.61 |
|  Estimated plasma volume | 23 | 5.1 [4.3-5.8] | 5.1 [4.7-6.2] | 0.39 | 23 | 4.7 [4.3-5.3] | 5.2 [4.3-5.8] | 0.11 | 0.56 |

Data are presented as median [interquartile range]

AHF: acute heart failure, BNP: B-type natriuretic peptide, CRP: C-reactive protein, eGFR: estimated glomerular filtration rate, hsTnI: high sensitive troponin I, MR-proANP: mid-regional pro-atrial natriuretic peptide, NGAL: neutrophil gelatinase associated lipocalin, sCD146: soluble cluster of differentiation 146, ST-2: suppression of tumorigenecity-2.

**Supplemental Table 8: Changes of biomarkers during hospitalization in AHF patients receiving IV furosemide only or IV furosemide plus vasodilators:**

|  |  |  |  |
| --- | --- | --- | --- |
|  | IV furosemide alone | IV furosemide plus vasodilators | Difference in percent change between groups |
| n | admission | discharge | p | n | admission | discharge | p | p |
| Markers of cardiovascular stress and congestion: |  |  |  |  |  |  |  |  |  |
| BNP (pg/mL) | 21 | 938[732-2375] | 311[196-573] | **<0.001** | 10 | 1660[797-2544] | 349[213-867] | **0.005** | 0.66 |
|  MR-proANP (pmol/L) | 27 | 523[300-765] | 433[283-643] | **0.01** | 13 | 545[346-770] | 433[270-678] | **0.005** | 0.39 |
|  sCD146 (ng/mL) | 27 | 500[403-647] | 433[399-509] | 0.09 | 13 | 483[331-554] | 389[325-500] | 0.25 | 0.69 |
|  hsTnI (pg/mL) | 25 | 45 [19-116] | 21 [14-54] | **0.04** | 13 | 25 [18-53] | 13 [10-74] | 0.81 | 0.41 |
| Markers of inflammation and fibrosis |  |  |  |  |  |  |  |  |  |
|  Soluble ST2 (ng/mL) | 27 | 85 [60-136] | 41 [37-60] | **<0.001** | 13 | 83 [72-138] | 42 [34-67] | **0.002** | 0.59 |
|  CRP (mg/L) | 26 | 8.0[4.2-28.9] | 7.8[3.0-26.8] | 0.06 | 13 | 17.4[6.8-34.3] | 16.7[6.4-37.2] | 0.28 | 0.23 |
|  Procalcitonin (ng/mL) | 25 | 0.10[0.08-0.12] | 0.09[0.06-0.14] | 0.19 | 13 | 0.14[0.12-0.20] | 0.14[0.08-0.18] | 0.92 | 0.43 |
| Biological markers of renal function: |  |  |  |  |  |  |  |  |  |
|  Creatinine (mg/dL) | 27 | 1.17[0.88-1.59] | 1.14[0.91-1.57] | 0.77 | 13 | 1.38[1.10-1.60] | 1.68[1.34-1.93] | **0.02** | **0.002** |
|  eGFR (mL/min/1.73m2) | 27 | 62 [37-75] | 62 [39-74] | 0.79 | 13 | 53 [34-62] | 41 [32-56] | **0.009** | **0.002** |
|  Cystatin C (mg/L) | 27 | 1.33[1.20-2.03] | 1.62[1.34-2.39] | **<0.001** | 13 | 1.98[1.42-2.35] | 2.43[1.33-2.81] | **0.01** | 0.71 |
|  Urea nitrogen (mmol/L) | 27 | 8.9[6.8-13.8] | 11.4[7.5-16.4] | 0.26 | 13 | 10.3[7.3-12.4] | 12.7[9.2-18.3] | **0.02** | 0.11 |
|  Uric acid (µmol/L) | 27 | 407[356-576] | 449[369-569] | 0.08 | 13 | 422[348-551] | 511[398-642] | 0.07 | 0.16 |
|  NGAL (ng/mL) | 24 | 119[91-265] | 154[106-256] | 0.42 | 13 | 186[114-275] | 234[102-318] | 0.06 | 0.91 |
| Markers of plasma volume: |  |  |  |  |  |  |  |  |  |
|  Hemoglobin (g/dL) | 31 | 13.0[11.8-13.9] | 12.5[11.2-13.5] | 0.20 | 12 | 13.2[11.0-13.8] | 11.7[11.0-12.8] | 0.05 | 0.22 |
|  Hematocrit (%) | 31 | 40 [36-42] | 38 [35-42] | 0.10 | 12 | 38 [35-41] | 35 [34-37] | 0.13 | 0.48 |
|  Estimated plasma volume | 31 | 4.8 [4.1-5.5] | 5.0 [4.3-5.7] | 0.15 | 12 | 4.7 [4.2-5.9] | 5.5 [4.9-6.0] | 0.07 | 0.27 |

Data are presented as median [interquartile range]

AHF: acute heart failure, BNP: B-type natriuretic peptide, CRP: C-reactive protein, eGFR: estimated glomerular filtration rate, hsTnI: high sensitive troponin I, MR-proANP: mid-regional pro-atrial natriuretic peptide, NGAL: neutrophil gelatinase associated lipocalin, sCD146: soluble cluster of differentiation 146, ST-2: suppression of tumorigenecity-2.