

TAVI for patients with pulmonary arterial hypertension – impact of the anesthesia regime on the short-term outcome

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Objectives and background: Pulmonary Arterial Hypertension (PAH) has been independently associated with increased rates of postoperative heart-failure, hemodynamic instability, respiratory failure and delayed extubation. PAH has been described as a common comorbidity in patients undergoing transfemoral Transcatheter Aortic Valve Implantation (tf-TAVI). Two different anesthetic methods, general anesthesia (TAVI-GA) and conscious sedation (TAVI-S) have become established. Both must be measured by their influence on pulmonary vascular resistance, as all factors worsening PAH have to be avoided. To date, there are no practice guidelines advising the the optimal anesthetic approach for patients with PAH.

Methods: We included all consecutive tf-TAVI patients between 2014 and 2019 in our prospective TAVI registry. A combined endpoint covering the aspects of hemodynamic stability, ventilation and awareness was chosen as primary endpoint. 1. Freedom from catecholaminergic support, 2. Spontaneous breathing and 3. Alertness, defined as GCS > 12 points were pre-requisite for achieving. PAH was diagnosed by echocardiography immediately before the procedure. The choice for TAVI-GA or TAVI was made by the anesthesiologist.

Results: A total of 1390 patients were included in this analysis. PAH was diagnosed in 74% (n=1031) of the patients. As shown in Tab.1, patients with and without PAH were comparable in terms of pre-procedural comor-

bidities, blood gas analysis before and after their procedure and procedural data. Postprocedural, a longer stay on ICU was observed in patients with PAH. This was also seen after propensity-score matching. In terms of the primary endpoint, no difference was found between the groups. In addition, the single points catecholaminergic support, spontaneous ventilation and awareness at the time of transfers revealed no difference. Same holds true for secondary endpoints like 30-day mortality, heart failure and adverse procedural events. An analysis based on the choice of anesthesia showed a clear difference in the successful achievement of the primary endpoint. Independent of the presence of PAH, patients undergoing the procedure in TAVI-GA the primary endpoint was less often successfully documented. TAVI-GA patients were more often in need of catecholaminergic support at the end of the procedure and a reduced alertness was more often found. In patients with PAH and TAVI-GA, a longer length of ICU-stay and a higher incidence of congestive heart failure (CHF) within 30days was found.

Conclusion: Independent of PAH, patients undergoing tf-TAVI in TAVI-GA, were more often in need of catecholaminergic support and less often awake at the end of the procedure. General anesthesia was also more often associated with CHF but not death at 30 days. The achievement of the primary endpoint was independent of the presence of PAH. If-TAVI can be done under sedation safely in patients with PAH.

	Unmatched population			Matched population		
	No PAH n=359	PAH n=1031	p-value	No PAH n=359	PAH n=718	p-value
Baseline						
Male (n=)	225 (62.7%)	520 (50.4%)	<0.001	225 (62.7%)	432 (60.2%)	0.466
Age (years)	81 [77 - 85]	82 [78 - 86]	0.027	81.0 [77.0 - 85.0]	81.0 [77.0 - 85.0]	0.767
PAP syst (mmHg)	25 [21-28]	45 [37-56]	<0.001	25 [21-28]	45 [37-54]	<0.001
Mean pressure gradient (mmHg)	44 [38-50]	42 [34-51]	0.067	44.0 [37.0-50.0]	43.0 [35.0-52.0]	0.546
LVEF (%)	60 [50-60]	60 [45-60]	0.001	60 [50-60]	60 [50-60]	0.489
prev. Cancer (n=)	72 (20.1%)	212 (20.6%)	0.897	72 (20.1%)	148 (20.6%)	0.894
EuroSCORE I log (%)	8.97 [6.59-13.1]	12.1 [7.94-20.5]	<0.001	8.97 [6.59-13.1]	10.2 [7.01-17.1]	<0.001
STS Mort (%)	3.27 [2.20-5.00]	4.24 [2.82-6.52]	<0.001	3.27 [2.20-5.00]	3.46 [2.48-5.11]	0.089
Periprocedural						
TAVI-GA (n=)	99 (27.6%)	333 (32.3%)	0.110	99 (27.6%)	227 (31.6%)	0.336
TAVI-S (n=)	260 (72.4%)	698 (67.7%)		260 (72.4%)	491 (68.4%)	
Blood Gas analysis						
Ambient air						
PaO2 (mmHg)	78.6 [70.6-86.7]	76.7 [68.4-85.2]	0.023	78.6 [70.6-86.7]	77.6 [69.2-84.7]	0.108
PaCO2 (mmHg)	34.9 [32.4-37.5]	35.0 [31.9-37.8]	0.857	34.9 [32.4-37.5]	35.1 [32.1-37.9]	0.925
pH	7.45 [7.42-7.46]	7.45 [7.43-7.47]	0.088	7.45 [7.42-7.46]	7.45 [7.43-7.46]	0.608
Handover to ICU						
PaO2 (mmHg)	80.5 [69.9-94.3]	80.3 [70.6-95.1]	0.630	80.5 [69.9-94.3]	80.2 [70.6-94.7]	0.784
PaCO2 (mmHg)	40.5 [36.8-43.6]	39.2 [35.1-42.8]	0.054	40.5 [36.8-43.6]	39.5 [35.3-42.6]	0.079
pH	7.39 [7.36-7.42]	7.39 [7.36-7.42]	0.521	7.39 [7.36-7.42]	7.39 [7.36-7.42]	0.893
Procedural data						
contrast (ml)	115 [90.0-145]	110 [90.0-140]	0.090	115 [90.0-145]	110 [94.2-140]	0.147
proc_time (min)	48.0 [41.0-60.0]	49.0 [40.0-59.0]	0.904	48.0 [41.0-60.0]	48.0 [40.0-59.0]	0.545
Outcome						
LOS ICU (days)	1.00 [1.00-1.00]	1.00 [1.00-2.00]	< 0.001	1.00 [1.00-1.00]	1.00 [1.00-1.00]	0.017
Maj. Vasc. Bleeding (n=)	34 (9.47%)	115 (11.2%)	0.430	34 (9.47%)	68 (9.47%)	0.999
CHF 30d (n=)	9 (2.51%)	30 (2.91%)	0.838	9 (2.51%)	18 (2.51%)	0.999
Death 30d (n=)	5 (1.40%)	18 (1.75%)	0.838	5 (1.40%)	10 (1.40%)	0.999
Endpoints (at transfer to ICU)						
Catecholamin. support (n=)	13 (3.62%)	56 (5.43%)	0.223	13 (3.62%)	37 (5.15%)	0.331
Ventilated (n=)	6 (1.67%)	26 (2.52%)	0.471	6 (1.67%)	16 (2.23%)	0.703
GCS < 12P (n=)	16 (4.46%)	55 (5.33%)	0.609	16 (4.46%)	36 (5.01%)	0.802
Combined EP successful (n=)	335 (93.3%)	926 (89.8%)	0.063	335 (93.3%)	649 (90.4%)	0.135

Table 1. Analysis with regard to PAH

	PAH +			PAH -		
	TAVI-GA n=333	TAVI-S n=698	p-value	TAVI-GA n=99	TAVI-S n=260	p-value
Baseline						
Male (n=)	176 (52.9%)	344 (49.3%)	0.315	59 (59.6%)	166 (63.8%)	0.534
Age (years)	82.0 [78.0-86.0]	82.0 [78.0-85.0]	0.609	80.0 [76.0-84.5]	81.0 [78.0-85.0]	0.124
PAP syst (mmHg)	46.0 [39.0-58.0]	45.0 [37.0-56.0]	0.041	26.0 [23.0-28.5]	25.0 [21.0-28.0]	0.038
Mean pressure gradient (mmHg)	42.0 [32.0-52.0]	42.0 [32.0-50.0]	0.668	44.0 [37.0-49.5]	44.0 [38.0-50.0]	0.878
LVEF (%)	60.0 [45.0-60.0]	60.0 [45.2-60.0]	0.321	60.0 [52.0-60.0]	60.0 [50.0-60.0]	0.706
EuroSCORE I log (%)	13.2 [7.81-22.3]	11.6 [7.94-19.4]	0.086	8.46 [6.19-12.9]	9.05 [6.61-13.2]	0.117
STS Mort (%)	4.66 [2.93-6.89]	4.01 [2.76-6.34]	0.012	3.43 [2.12-5.32]	3.25 [2.22-4.88]	0.556
Blood Gas analysis						
Ambient air						
PaO2 (mmHg)	76.9 [68.0-85.3]	76.6 [68.6-85.1]	0.674	81.1 [69.3-91.2]	78.4 [71.0-85.5]	0.532
PaCO2 (mmHg)	35.1 [31.7-37.4]	35.0 [32.0-37.8]	0.616	34.9 (4.38)	35.2 (4.38)	0.613
pH	7.45 [7.43-7.47]	7.45 [7.43-7.47]	0.663	7.45 [7.43-7.46]	7.45 [7.42-7.47]	0.973
Handover to ICU						
PaO2 (mmHg)	133 [81.3-152]	79.7 [70.0-93.2]	<0.001	79.5 [68.3-86.4]	80.5 [69.7-94.9]	0.331
PaCO2 (mmHg)	42.1 [38.8-47.3]	38.9 [34.9-42.4]	0.014	45.0 [37.9-50.0]	40.5 [36.8-43.6]	0.313
pH	7.37 [7.34-7.39]	7.39 [7.36-7.42]	0.015	7.32 [7.27-7.36]	7.39 [7.36-7.42]	0.609
Procedural data						
contrast (ml)	120 [90.0-150]	110 [90.0-130]	0.011	120 [102-160]	110 [90.0-135]	0.001
proc_time (min)	54.0 [45.0-67.0]	46.0 [38.0-56.0]	<0.001	55.0 [43.0-72.0]	46.5 [39.0-57.0]	<0.001
Outcome						
LOS ICU (days)	1.00 [1.00-2.00]	1.00 [1.00-1.00]	<0.001	1.00 [1.00-1.00]	1.00 [1.00-1.00]	0.056
Maj. Vasc. Bleeding (n=)	69 (20.7%)	46 (6.59%)	<0.001	13 (13.1%)	21 (8.08%)	0.208
CHF 30d (n=)	16 (4.80%)	14 (2.01%)	0.021	3 (3.03%)	6 (2.32%)	0.712
Death 30d (n=)	8 (2.41%)	10 (1.43%)	0.389	1 (1.02%)	4 (1.54%)	0.999
Endpoints (at transfer to ICU)						
Catecholamin. support (n=)	33 (9.91%)	23 (3.30%)	<0.001	8 (8.08%)	5 (1.92%)	0.009
Ventilated (n=)	21 (6.31%)	5 (0.72%)	<0.001	4 (4.04%)	2 (0.77%)	0.051
GCS < 12P (n=)	33 (9.91%)	22 (3.15%)	<0.001	10 (10.1%)	6 (2.31%)	0.003
Combined EP successful (n=)	275 (82.6%)	651 (93.3%)	<0.001	83 (83.8%)	252 (96.9%)	<0.001

Table 2. Analysis with regard to Anesth