Online Supplement for

NAVA enhances tidal volume and diaphragmatic electro-myographic activity matching - A Range90 analysis of Supply and Demand

The following shows the method for Range90 calculation in a patient:

1. Obtain tidal volume (*Vt*) and *∫Eadi* for each breathing cycle as shown in Figure 1 and 2.
2. The Neuroventilatory efficiency (*Vt*/*∫Eadi* ratio) for each breathing cycle is calculated. (Example: $Vt_1/\int Eadi_1$, $Vt_2/\int Eadi_2$, $Vt_3/\int Eadi_3$, $Vt_4/\int Eadi_4$ …, $Vt_n/\int Eadi_n$).
3. The 5th percentile of every *Vt*/ *∫Eadi* ratio is determined (5th *Vt*/ *∫Eadi*).
4. The 95th percentile of every *Vt*/ *∫Eadi* ratio is determined (95th *Vt*/ *∫Eadi*).
5. Range90 = 95th *Vt*/ *∫Eadi* - 5th *Vt*/ *∫Eadi*
6. For a patient who has consistent *Vt*/ *∫Eadi* ratio, Range90 will be smaller.
7. For a patient who has variable *Vt*/ *∫Eadi* ratio, Range90 will be higher.

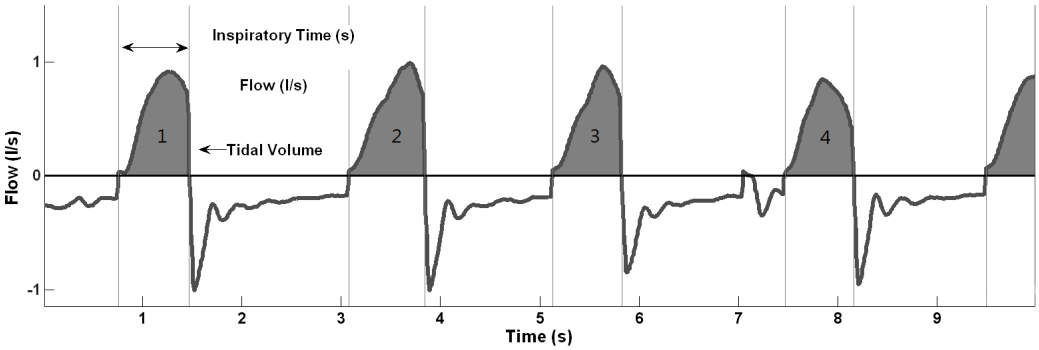

Figure 1: Example of a patient's flow-time curve. The shaded area is the ventilator supply (Tidal volume, *Vt*)

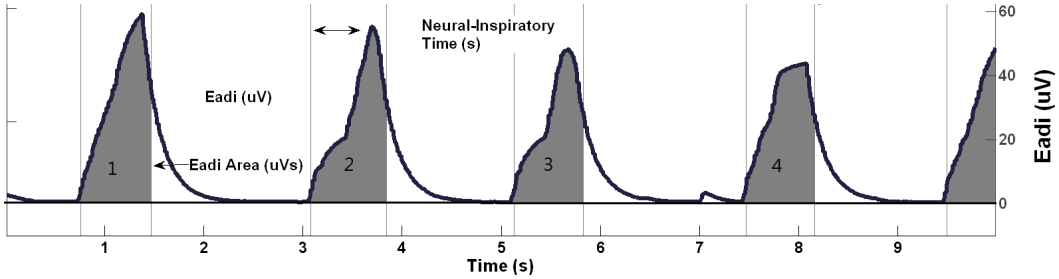

Figure 2: Example of a patient's *Eadi*-time curve. The shaded area is the patient's demand (*∫Eadi*)

Case examples comparing better and less matching
Example: *Vt* = 1.0 and *∫Eadi* = 1.0 for baseline value

Case A - Patient with better matching
∫Eadi = 1.0, *Vt* = 1.0, *Vt*/ *∫Eadi* = 1.0 (Moderate demand, Moderate supply)
∫Eadi = 2.0, *Vt* = 2.0, *Vt*/ *∫Eadi* = 1.0 (High demand, High supply)
∫Eadi = 0.5, *Vt* = 0.5, *Vt*/ *∫Eadi* = 1.0 (Low demand, Low supply)
…
95th -5th of all *Vt*/ *∫Eadi* for Case A will be small resulting in smaller Range90 value.

Case B - Patient with less matching
∫Eadi = 1.0, *Vt* = 2.0, *Vt*/ *∫Eadi* = 2.0 (Moderate demand, High supply)
∫Eadi = 2.0, *Vt* = 1.0, *Vt*/ *∫Eadi* = 0.5 (High demand, Moderate supply)
∫Eadi = 0.5, *Vt* = 1.0, *Vt*/ *∫Eadi* = 1.0 (Low demand, Moderate supply)
…
Thus, 95th -5th of all *Vt*/ *∫Eadi* for Case B will be higher, with larger Range90 value compared to Case A

Table E1 shows the median [IQR] values for $\int Eadi$, Vt, $Ti_{\_Neural}$, Ti and PIP for all 22 patients for PS and NAVA (The details for Table 2).

Table E1: Median [IQR] values for $\int Eadi$, Vt, $Ti_{\_Neural}$, Ti and PIP for all 22 patients for PS and NAVA.

Patients		$\int Eadi(\mu Vs)$	Vt (ml)	$Ti_{\_Neural}$ (s)	Ti (s)	$PIP(cmH_2O)$
1	**PS**	3.01 [2.71-3.36]	671 [653-687]	0.94 [0.90-1.02]	1.20 [1.18-1.23]	20.40 [20.33-20.46]
	NAVA	3.80 [3.37-4.46]	626 [584-671]	1.02 [0.95-1.09]	1.20 [1.14-1.29]	21.89 [20.56-23.43]
2	**PS**	1.02 [0.71-1.96]	449 [394-517]	0.79 [0.63-0.92]	1.05 [0.99-1.13]	15.25 [14.99-15.64]
	NAVA	2.06 [1.21-4.13]	303 [180-529]	0.76 [0.55-0.93]	0.92 [0.76-1.06]	12.26 [9.85-17.97]
3	**PS**	1.90 [1.42-2.64]	463 [454-472]	0.86 [0.79-0.94]	1.00 [0.97-1.03]	24.56 [24.50-24.69]
	NAVA	1.71 [1.39-1.97]	472 [382-520]	0.86 [0.68-0.98]	1.05 [0.89-1.14]	31.33 [27.62-35.37]
4	**PS**	12.28 [10.67-13.90]	418 [400-435]	0.50 [0.45-0.54]	0.65 [0.63-0.68]	21.57 [21.50-21.63]
	NAVA	13.08 [11.39-15.05]	412 [387-442]	0.53 [0.49-0.59]	0.71 [0.67-0.77]	21.89 [20.59-23.36]
5	**PS**	4.35 [3.81-5.03]	510 [495-525]	0.57 [0.52-0.62]	0.80 [0.76-0.82]	25.21 [25.08-25.41]
	NAVA	3.11 [2.68-3.74]	423 [384-475]	0.54 [0.49-0.60]	0.65 [0.61-0.71]	24.56 [22.46-27.06]
6	**PS**	7.33 [4.88-9.59]	336 [318-353]	0.47 [0.39-0.55]	0.81 [0.77-0.84]	19.42 [19.29-19.48]
	NAVA	6.64 [5.62-7.63]	293 [257-325]	0.56 [0.52-0.65]	0.79 [0.70-0.87]	18.12 [16.23-19.48]
7	**PS**	3.18 [1.70-4.17]	528 [486-555]	0.43 [0.36-0.49]	0.68 [0.61-0.71]	25.54 [25.47-25.60]
	NAVA	4.20 [2.73-4.83]	476 [434-513]	0.44 [0.38-0.49]	0.56 [0.51-0.60]	24.43 [21.76-26.06]
8	**PS**	3.94 [2.68-4.98]	460 [432-479]	0.51 [0.46-0.57]	0.57 [0.55-0.61]	20.46 [20.40-20.53]
	NAVA	2.10 [1.81-2.43]	462 [429-498]	0.70 [0.61-0.77]	0.81 [0.74-0.87]	21.37 [19.09-23.85]
9	**PS**	5.27 [4.72-5.96]	411 [396-423]	0.60 [0.57-0.63]	0.70 [0.68-0.72]	21.50 [21.44-21.57]
	NAVA	5.97 [5.36-6.86]	393 [361-426]	0.60 [0.57-0.64]	0.72 [0.69-0.75]	23.91 [21.78-25.91]
10	**PS**	2.46 [2.06-2.87]	382 [352-407]	1.07 [0.96-1.20]	1.45 [1.39-1.52]	14.15 [14.02-14.34]
	NAVA	2.88 [2.41-3.38]	319 [282-342]	1.02 [0.82-1.14]	1.24 [1.10-1.34]	10.76 [10.05-11.54]
11	**PS**	7.31 [6.53-8.16]	397 [389-406]	0.48 [0.44-0.52]	0.54 [0.53-0.55]	28.79 [28.66-29.12]
	NAVA	7.75 [6.60-9.17]	378 [350-408]	0.44 [0.40-0.49]	0.59 [0.55-0.64]	31.98 [29.77-35.47]
12	**PS**	11.97 [8.14-17.64]	474 [437-501]	0.69 [0.61-0.76]	0.93 [0.89-0.99]	14.73 [14.60-14.86]
	NAVA	12.00 [9.91-14.90]	456 [418-486]	0.66 [0.60-0.75]	0.84 [0.78-0.91]	13.50 [12.06-15.32]
13	**PS**	2.90 [1.71-5.59]	345 [317-384]	0.45 [0.28-0.67]	1.14 [1.05-1.27]	17.21 [17.08-17.53]
	NAVA	3.14 [1.66-5.94]	220 [124-397]	0.54 [0.36-0.69]	0.70 [0.54-0.83]	16.98 [13.01-25.57]
14	**PS**	1.86 [1.25-2.38]	473 [417-516]	0.62 [0.47-0.72]	0.73 [0.68-0.80]	23.07 [22.87-23.20]
	NAVA	3.13 [0.96-5.32]	394 [108-560]	0.58 [0.38-0.71]	0.79 [0.60-0.89]	19.78 [10.89-24.17]
15	**PS**	5.66 [4.67-8.41]	507 [459-538]	0.61 [0.53-0.69]	1.15 [0.96-1.26]	24.11 [23.98-24.24]
	NAVA	5.91 [4.90-6.91]	544 [475-613]	0.74 [0.65-0.82]	0.92 [0.84-0.99]	32.63 [28.17-38.82]
16	**PS**	5.99 [5.25-6.97]	622 [608-634]	0.79 [0.73-0.85]	0.93 [0.90-0.96]	18.77 [18.70-18.90]
	NAVA	6.77 [6.04-7.68]	615 [583-644]	0.84 [0.75-0.87]	0.96 [0.90-1.03]	20.53 [18.90-22.67]
17	**PS**	4.42 [3.24-5.61]	633 [579-727]	0.32 [0.18-0.44]	1.19 [1.07-1.35]	21.37 [21.31-21.50]
	NAVA	5.79 [3.83-7.77]	453 [341-568]	0.44 [0.34-0.54]	0.64 [0.51-0.79]	19.68 [16.84-22.94]
18	**PS**	4.26 [3.51-5.09]	476 [465-489]	0.63 [0.53-0.77]	1.05 [1.01-1.10]	23.52 [23.39-23.59]
	NAVA	4.13 [3.11-5.40]	429 [326-514]	0.65 [0.50-0.78]	0.87 [0.73-0.96]	24.63 [21.11-28.39]
19	**PS**	2.74 [1.46-4.56]	514 [406-586]	0.32 [0.20-0.48]	1.15 [0.80-1.43]	22.64 [22.41-23.33]
	NAVA	1.83 [1.49-2.24]	292 [241-336]	0.40 [0.32-0.47]	0.54 [0.48-0.61]	24.11 [21.57-27.75]
20	**PS**	1.73 [1.50-1.97]	445 [430-462]	0.54 [0.42-0.64]	1.03 [0.99-1.06]	18.57 [18.51-18.64]
	NAVA	2.31 [2.01-2.73]	432 [380-488]	0.67[0.58-0.75]	0.87 [0.79-0.98]	20.04 [18.12-21.96]
21	**PS**	2.55 [2.21-2.96]	836 [800-854]	0.87 [0.73-1.08]	1.16 [1.06-1.32]	14.99 [14.86-15.06]
	NAVA	2.59 [1.56-3.29]	758 [586-848]	0.71 [0.55-0.84]	0.92 [0.69-1.04]	19.61 [15.79-23.41]
22	**PS**	22.51 [17.90-25.43]	431 [399-460]	0.38 [0.32-0.45]	0.58 [0.53-0.62]	26.84 [26.78-26.91]
	NAVA	19.96 [17.25-22.44]	440 [394-478]	0.46 [0.40-0.52]	0.60 [0.54-0.63]	35.50 [33.09-37.84]