

Hemodynamic monitoring with trans-thoracic bioactance in high risk surgery

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Introduction: despite recent anesthesiological and surgical progresses, perioperative mortality remains higher than expected (over 10% in high risk surgery) (1). Perioperative hemodynamic optimization significantly improves outcome, preventing hypoperfusion in high risk patients (2). Transthoracic bioactance (NICOM®) is a recent and less invasive device validate in critical setting (3).

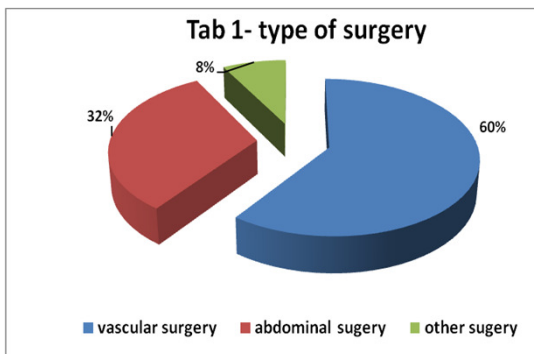
Aim: we value usefulness of cardiac output monitoring and optimization in high risk setting using less invasive transthoracic bioactance.

Methods: this is a prospective study. Setting: 11 operating rooms in our hospital (Asti). *Inclusion criteria:* high risk patient is defined according literature (4). Cardiac or respiratory illness with severe functional limitation, aged > 70 years with moderate functional limitation of one or more organ systems, acute massive blood loss (>2.5 l), severe sepsis, shock or severe hypovolemia of any origin, acute gastrointestinal failure (e.g. intra-abdominal compartment syndrome, pancreatitis, perforated viscus, gastrointestinal bleeding), acute renal failure (urea >20 mmol/l, creatinine >260mmol/l), extensive non-cardiac surgery, vascular surgery. *Exclusion criteria:* right ventricular dysfunction or pulmonary hypertension. *Protocol:* transthoracic bioactance system was placed according figure 1 before induction of anesthesia. During surgery hemodynamic optimization was realized according to measured parameters. *Data collected:* age, sex, ASA, type of surgery, emergency, preoperative cardiac or renal failure, type of anesthesia (general or peripheral); hemodynamic data: heart rate (HR), mean arterial pressure (MAP), stroke volume index (SVI); cardiac index (CI), total peripheral resistance index (TPRI), stroke volume variation (SVV). Data measured before and after induction (T1 e T2), at the end of surgery (T3), at discharged from operating room (T4). End point: proportion of hemodynamic optimization (CI >2,5 l/min/m²) and perioperative "silent" hypoperfusion. Statistic: numerical data presented as mean ± DS or median and range, ordinal data as proportion. T student's test used. P significant if < 0.05.



Fig. 1 –Trans-thoracic bioactance positioning

Results: 40 consecutive patients, mean age 69±10 y, 65% male, 36% female, ASA 3 (2-4), type of surgery is summarized in table 1. 22% emergency intervention; 40% preoperative cardiac failure, 7,5% renal failure. 93% general and 7 % peripheral anesthesia. Despite a not significant post-induction hemodynamic worsening, parameters were maintained constant during surgery in over 70% with an adequate cardiac function monitored during surgery (summarized in tab 2).



Tab 2 – hemodynamic parameters	T1	T2	T3	T4	P
CI (l/min/ m ²)	2,7±0,6	2,5±0,5	2,4±0,6	2,7±0,8	NS
SVI (ml/min/ m ²)	36±8	33±9	33±9	33±9	NS
TPRI (dyne/sec/cm ⁵ /m ²)	2677±744	2730±999	2617±1021	2655±938	NS
SVV (%)	-	14±3	13±3	-	NS

T1: before induction, T2: after induction, T3 at the end of surgery, T4 before discharge form operative room.

In over 30% of cases a preoperative hemodynamic hypoperfusion (CI < 2,5 /min/m²) was monitored despite a "silent" clinical picture. Preoperative and intraoperative data are summarized in tab 3 and 4. 3/40 (7,5%) patients died in postoperative period.

Tab. 3 – Preoperative data	Control	"Silent" hypoperfusion	P
N°	27	13	
Age	70±8	70±11	NS
Male	17/27 (63%)	9/13 (70%)	NS
ASA	3	3	NS
Emergency	6/27 (22%)	3/13 (22%)	NS
Preoperative cardiac failure	10/27 (37%)	7/13 (54%)	< 0.05

Tab. 4 –Intraoperative hemodynamic data	Control	"Silent" hypoperfusion	P
CI (l/min/m ²)	2.7 ± 0.8	2.1 ± 0.5	0.04
SVI (ml/beat/m ²)	38 ± 7	31 ± 8	0.02
SVV (%)	14 ± 3	15 ± 3	NS
TPRI (dyne/sec/cm ⁵ /m ²)	2870 ± 947	2790 ± 1125	NS
HR (beats/min)	77 ± 4	70 ± 16	NS
MAP (mmHg)	90 ± 26	80 ± 17	NS

Conclusion: perioperative mortality is still higher than expected in particular in high risk surgical patients. The leading cause is a relative and often underestimated tissue hypoperfusion. A recent and less invasive monitoring device using trans-thoracic bioactance (NICOM®) can be a useful method for hemodynamic management. It can detect, in high risk patients, "silent" hemodynamic failure and improves perioperative hemodynamic optimization

References

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