Automatic Identification of Shunts by COstatus® PICU Monitor

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BACKGROUND
The shape of dilution curve changes dramatically after an indicator passes through the cardiopulmonary system in the presence of intra-cardiac shunts and a patent ductus arteriosus (PDA).

OBJECTIVE
To develop an accurate algorithm for shunt identification and apply it to archived clinical data.

STUDY
- A mathematical model of indicator movement through the cardiopulmonary system for three scenarios was developed. They were:
  1) No shunt;
  2) Right-to-left shunt;
  3) Left-to-right shunt.
- Three parameters of the dilution curve were examined:
  1) appearance time;
  2) asymmetry;
  3) curve width.
- Three possible scenarios were defined based on the probability “P” of shunt identification:
  1) No shunt, P < 5%;
  2) Possible shunt; 5% < P < 90%;
  3) Shunt identified P > 90%
- In the model, the values for cardiac output, heart size and heart rate were varied.
- In play-back mode the developed algorithm was applied to a clinical data archive of 1,188 dilution curves collected from adults (n=131) and from children (n=112) weighing between 0.9 -130 kg.

RESULTS
Sensitivity of the method was 94%, and false positive diagnostic was 0.9%.

STUDY’S CONCLUSIONS
- Automatic identification of shunts and PDA with the COstatus® monitor yielded acceptable accuracy.
- The new COstatus® monitor identifies the presence of intra-cardiac shunts based on a developed algorithm, in addition to measuring cardiac output and blood volumes.
- A follow-up step will be to quantify the observed shunt flow values.

REFERENCES
Krivitski N. "Identification of Shunts Based on the Shape of the Dilution Curve," 3rd Congress of European Academy of Paediatric Societies (EAPS), Copenhagen, Denmark, Oct. 23-26 2010, Poster Presentation #121 (Transonic Reference # CO8042)