

# Pengaruh resusitasi cairan terhadap hemodinamik sus scrofa sebagai model renjatan: kajian pada atrial natriuretic peptide, glycocalyx endotel, dan pasokan oksigen = Impact of fluid resuscitation on sus scrofa, investigation on atrial natriuretic peptide endothelial glycocalyx, and delivery oxygen

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## Abstrak

Panduan resusitasi anak umumnya menganjurkan pemberian cairan dalam jumlah besar. Beberapa penelitian memperlihatkan bahwa penggunaan cairan yang agresif meningkatkan mortalitas. Penelitian pada hewan menunjukkan tekanan vena sentral yang tinggi memicu pelepasan atrial natriuretic peptide ANP, sementara penelitian invitro memperlihatkan ANP meluruhkan glycocalyx endotel vaskular dan meningkatkan permeabilitas endotel. ANP juga memicu vasodilatasi. Hemodilusi berpotensi menurunkan pasokan oksigen tubuh DO<sub>2</sub>. Penelitian bertujuan untuk melihat pengaruh resusitasi cairan terhadap kadar ANP serum, peluruhan glycocalyx endotel vaskular, extravascular lung water index ELWI, mean arterial pressure MAP, kadar hemoglobin dan pasokan oksigen. Hewan model renjatan adalah 11 ekor Sus scrofa jantan, usia 6-10 minggu. Renjatan dilakukan dengan metode fixed pressure hemorrhage. Resusitasi pertama dilakukan dengan jumlah cairan sesuai darah yang dikeluarkan resusitasi normovolemik, dilanjutkan dengan 40 mL/kg resusitasi hipervolemik. Pengukuran hemodinamik dilakukan dengan PICCO. Serum ANP dan Syndecan-1, petanda peluruhan glycocalyx, dilakukan dengan teknik ELISA. Hasil penelitian menunjukkan terjadinya peningkatan ANP pasca resusitasi normovolemik  $p = 0,043$ , yang kemudian menurun kembali dalam 30 menit. Peluruhan glycocalyx tidak terjadi. Perbedaan ELWI pada 60 menit pasca resusitasi secara statistik bermakna, dengan perbedaan 0,93 mL/kg 95 IK:0,19 -3,62. Terdapat korelasi kuat antara SVRI dan CI pasca resusitasi hipervolemik  $r = -0,587$ . Tidak ada perbedaan MAP pasca resusitasi normovolemik dan hipervolemik. Kadar hemoglobin pasca resusitasi hipervolemik lebih rendah daripada pasca resusitasi normovolemik  $p = 0,009$ . Pasokan oksigen tubuh pasca resusitasi hipervolemik lebih tinggi daripada pasca resusitasi normovolemik  $p = 0,012$ . Simpulan: Resusitasi cairan pada renjatan akibat perdarahan tidak mengakibatkan peluruhan glycocalyx endotel vaskular. Peningkatan ELWI amat terbatas. SVRI berkorelasi terbalik dengan CI. Tidak ada perbedaan MAP antara resusitasi normovolemik dan hipervolemik. Resusitasi hipervolemik menyebabkan hemodilusi yang diimbangi dengan peningkatan curah jantung.

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Many pediatric guidelines recommend liberal fluid resuscitation, but recent studies showed that aggressive fluid resuscitation might increase mortality. Animal studies showed that high central venous pressure induced ANP secretion. Invitro studies showed convincing evidence that ANP induced glycocalyx shedding. ANP also induced vasodilatation through cGMP signal transduction pathways. Hemodilution due to a large amount of resuscitation fluid potentially decreasing oxygen delivery. The objectives of this study were investigating the effect of fluid resuscitation, in the animal model, with special concern on serum ANP, glycocalyx shedding indicate by serum Syndecan-1, changes in extravascular lung water, systemic vascular resistance and mean arterial pressure, hemoglobin level and oxygen delivery DO<sub>2</sub>. The animal models were 11 male domestic pigs, 6-10 weeks old. The shock was induced with fixed pressure hemorrhage method.

Fluid resuscitation was done in 2 phases. On the first attempt, we replaced total numbers of blood that withdrawn normovolemic resuscitation . On the second attempt, we gave 40 mL/kg resuscitation fluids hypervolemic resuscitation . The hemodynamic measurements were done with PICCO. Serum ANP and Syndecan-1 were measure with ELISA method. We found that serum ANP increased after normovolemic resuscitation  $p = 0.043$  and immediately back to base level in 30 minutes. Glycocalyx shedding did not occur. Extravascular lung water index minimally increased. There was a strong correlation between SVRI and CI at hypervolemic resuscitation  $r = -0.587$  . There was no difference in mean arterial pressure between normovolemic and hypervolemic resuscitation. Hemoglobin level after hypervolemic resuscitation was lower than after normovolemic resuscitation  $p = 0.009$  . Oxygen delivery was higher after hypervolemic resuscitation  $p = 0.012$  .Conclusions: Hypervolemic resuscitation in this hemorrhagic shock model did not induce glycocalyx shedding, extravascular lung water index minimally increased. Systemic vascular resistance index negatively correlated to cardiac index. Fluid resuscitation may induce hemodilution, but oxygen delivery can be compensated by increasing cardiac output.