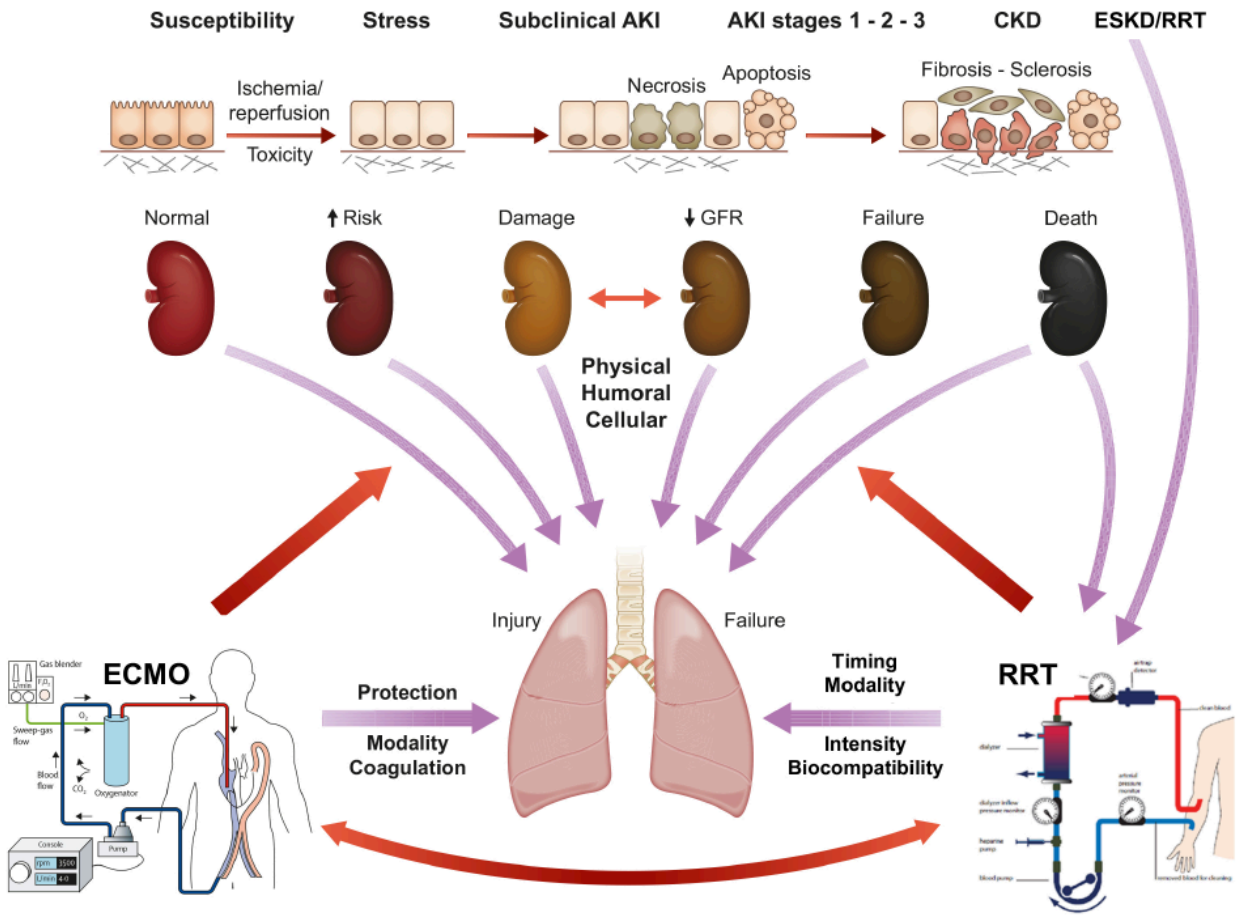
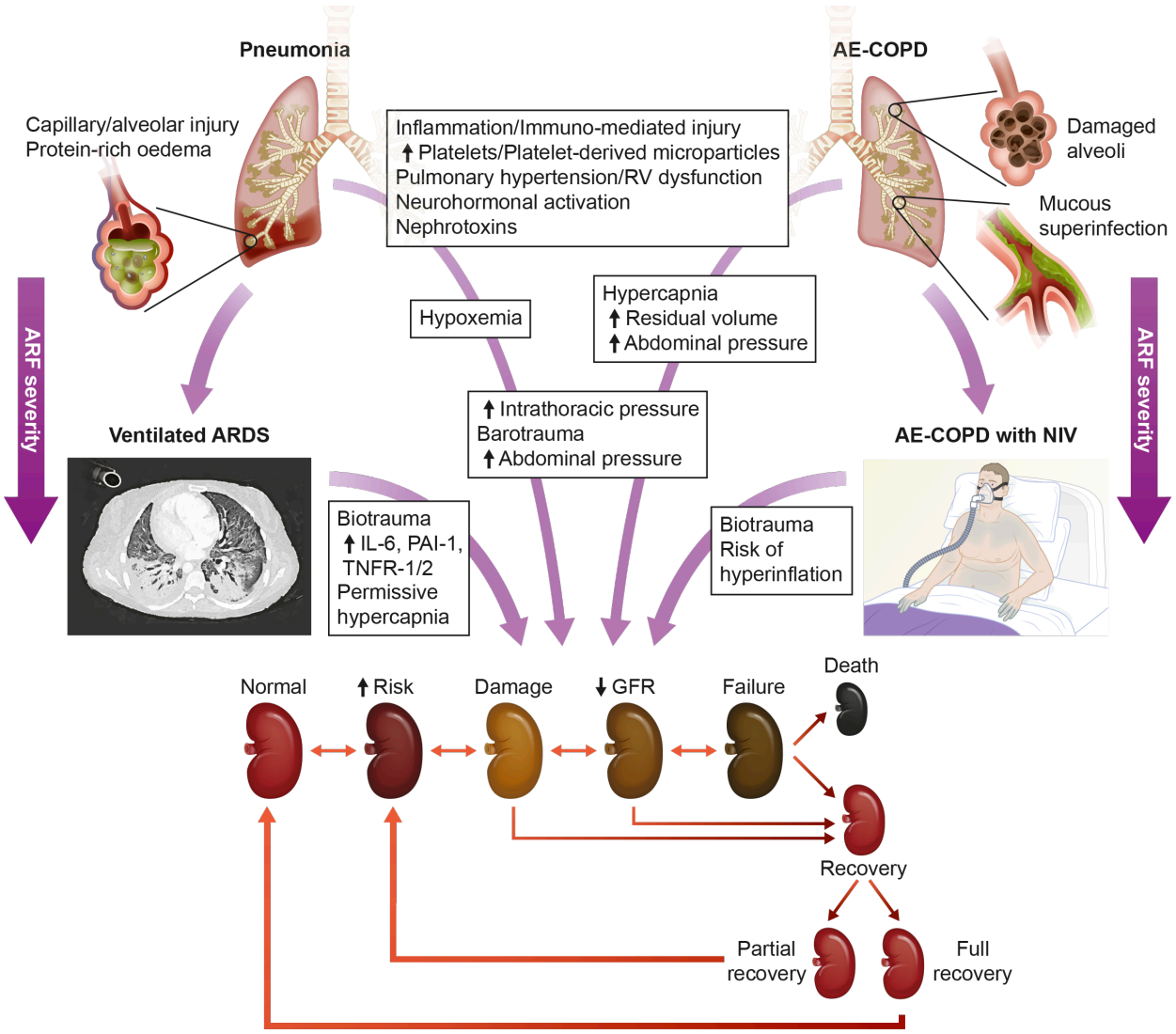
ADQI 21 Figures

Figure 1.



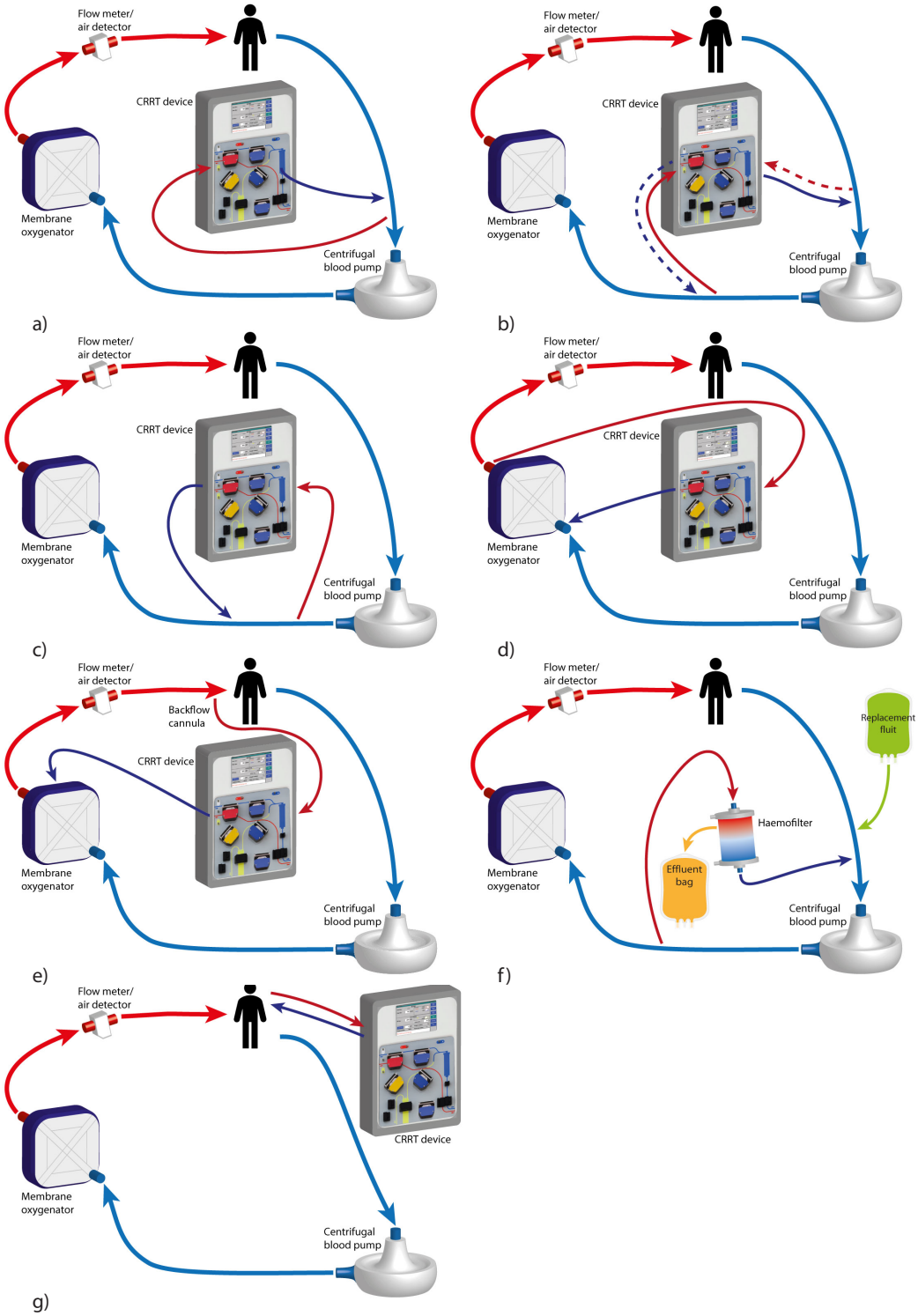
Possible effects of kidney injury and extracorporeal devices on pulmonary function. Depending on the stage of kidney injury, different processes take place in the injured kidney (e.g. inflammation, necrosis, apoptosis, fibrosis) having different impacts on and possibly injuring the lung trough fluid overload, humoral and cellular mechanisms. Extracorporeal devices for renal and respiratory support may interfere with these processes having possible protective but also detrimental effects on organ function. Renal and pulmonary failure may require combined application of RRT and ECMO

Figure 2.



Possible effects of acute respiratory failure and invasive/non-invasive ventilation on renal function. Both pneumonia and acute exacerbated COPD (AE-COPD) may trigger renal injury by various pathways. These include inflammation/immuno-mediated injury, hypoxaemia, hypercapnia and nephrotoxins. In AE-COPD, air trapping with increased thoracic pressures and right heart failure is frequently contributing to venous congestion. If invasive mechanical ventilation is necessary (e.g. ARDS) biotrauma, barotrauma, release of inflammatory mediators (e.g. IL-6, PAI-1, TNFR-1/2) and haemodynamic compromise may occur. These mechanisms may further contribute to kidney injury eventually leading to impaired GFR up to renal failure. Consequently, renal recovery may occur if the insulting factors are eliminated depending on the degree of injury whether partial or full recovery occurs

Figure 3.


Flow meter/
air detector
CRRT device
Membrane
oxygenator
Centrifugal
blood pump
a)
b)
Backflow
cannula
Replacement
fluid
Haemofilter
Effluent
bag
c)
d)
e)
f)
g)

Different possible methods to combine ECMO and CRRT circuits. a The inlet and the outlet of the CRRT device are connected before the centrifugal blood pump in the negative/low-pressure part of the ECMO circuit. High risk of air aspiration. b The inlet of the CRRT device is connected after the centrifugal blood pump in the high-pressure part of the ECMO circuit, while the CRRT outlet is connected before the centrifugal blood pump in the low-pressure part. Another possibility would be the connection of the inlet in the low-pressure part and the outlet in the high-pressure part. Every connection at the low-pressure part has a high risk of air aspiration. c Both the inlet and the outlet of the CRRT device are connected in the high-pressure part after the centrifugal blood pump. d The inlet of the CRRT device is connected directly after the membrane oxygenator, while the outlet is connected directly before the oxygenator. The minimal re-circulation is outweighed by increased safety as the gas exchange membrane is used as a clot and air trap. e The inlet of the CRRT device is connected to the additional port of the backflow cannula, while the outlet is connected directly to the membrane oxygenator. This approach keeps the connectors pre and post oxygenator available for pressure and gas exchange monitoring of the oxygenator. f A haemofilter is integrated into the ECMO circuit in-line, therefore relying on blood flow and pressure provided by the ECMO device alone. Replacement fluid is directly supplied into the ECMO circuit. The inlet of the haemofilter is connected after the centrifugal blood pump into the high-pressure part, while the outlet is connected before the centrifugal blood pump to create a sufficient pressure gradient. g The CRRT device is connected to the patient through a separate catheter and, therefore, being independent of the ECMO circuit