Acute feto-fetal transfusion simulation in monochorionic diamniotic twins
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Objective
Analysis of the specific risk of acute feto-fetal transfusion (F-F TRF) in different clinical subtypes of monochorionic diamniotic (MCDA) twins in case of significant deterioration or death of one twin.

Methods
Prospective analysis of 118 MCDA placentas using in vitro simulation of acute F-F TRF during the period 2015-2018. All fresh placentas were prepared and analysed according to the specific clinical protocols. Placental areas, umbilical cord insertions, numbers, diameters and types of interfetal placental vascular anastomoses were evaluated. Application of the mean artery pressure of 30mmHg and 40mmHg was used for the second and third trimester respectively and simulated an alive fetus. The leakage time of 1ml dye flowed out from the second umbilical cord simulated a dead fetus. All placentas were divided according to the clinical courses into the following subgroups: Physiological course (PC) n=76, selective fetal growth restriction (sFGR) n=22 and twin-to-twin transfusion syndrome (TTTS) Quintero stage I without intrauterine intervention (TTTS 1) n=10. All cases of TTTS Quintero stages II and higher underwent laser ablation of placental anastomoses with the Salomon technique. The latter specific subgroup (TTTS 2) was also analysed, interfetal vascular anastomoses were recorded during the intrauterine interventions n=10.

Results
All 118 MCDA placentas had at least some type of interfetal placental vascular anastomosis. The overall number of cases of proven F-F TRF was 47, 6 % (56/118) and the mean transfusion time of 1 ml of dye was 62, 7 seconds (12 – 240 sec). Presence of arterio-arterial (AA) anastomosis was in 70% (83/118) cases and 67% (56/83) of them had proven acute F-F TRF. In cases of absence of AA anastomosis acute F-F TRF were not present (0/35). Presence of AA anastomoses was significantly higher in FC and sFGR compared to TTTS 1 and TTTS 2 (p=0. 002). The risk of acute F-F TRF due to AA anastomosis was therefore higher in sFGR 50% (12/24) and FC 49% (37/76) compared to TTTS 1 20% (2/10) and TTTS 2 0% (0/10). Umbilical cord insertions distance less than 10 cm negatively correlated with the diameter of AA anastomosis and the risk of acute F-F TRF (p = 0. 007). All cases with umbilical cord insertions less than 4cm had acute F-F TRF was proven.

Conclusion
Proven acute F-F TRF is different for typical clinical courses of MCDA twins. The pathophysiological background is the presence of placental low-resistance AA vascular anastomoses. The mechanism of acute F-F TRF due to AA anastomoses is faster and absolutely different from the subacute or chronic F-F TRF known in TTTS or TAPS (twin anemia polycythemia sequence) caused by deep arterio-venous anastomoses frequently without the presence of AA anastomoses. Presence of AA anastomosis is protective to TTTS and TAPS. Close umbilical cord insertions increase the probability of acute F-F TRF due to the presence AA anastomosis.