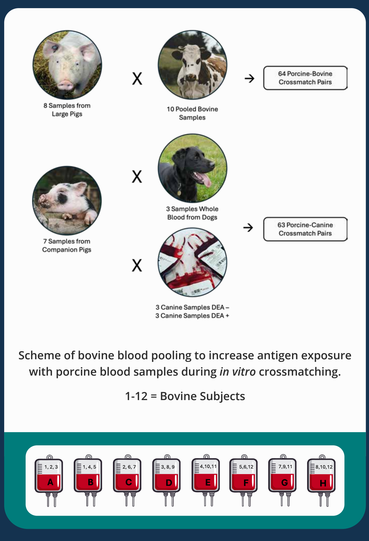
In vitro feasibility of bovine and canine whole blood and commercially prepared canine packed red blood cells as a source of xenotransfusion in swine (*Sus scrofa domestica*)

Since sourcing porcine blood donors for emergent transfusions to porcine patients is difficult, bovine or canine blood donors might represent alternative sources. The primary objective of this study was to determine the frequency of incompatible major (CMMa) and minor (CMMi) crossmatches by the standard saline agglutination tube method (SSA) between bovine whole blood (bWB) and whole blood from commercial pigs (pWB), and canine universal donor whole blood or commercially-prepared packed red blood cells (pRBCs) with whole blood from companion pigs. A secondary objective was determining the agreement between the reference method (SSA) and a quick slide (QS) method.

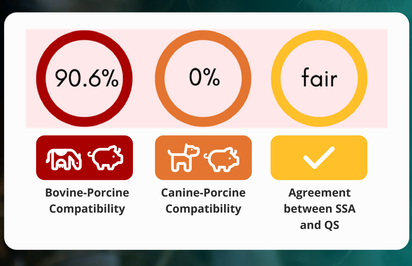
METHODS

Blood was collected from 12 heifers, 7 companion pigs, and 8 commercial-cross pigs. A0 blood typing was performed for all porcine samples. Bovine blood was pooled into 8 bags each containing 3 crossmatch-compatible individuals. Canine blood included whole blood from 3 canine blood donors (DEA 1.1, 5, 7 negative, and DEA 4 positive), and 3 bags each of DEA 1.1 negative and DEA 1.1 positive pRBCs. Crossmatch pairs were performed for bovine-to-porcine (n = 64) and canine-to-porcine (n = 63) samples. Incompatibility was defined as any agglutination or hemolysis on either CMMa and CMMi and reported separately. Complete incompatibility was defined as incompatibility of both CMMa and CMMi on the same pair. Kappa statistics tested the agreement between SSA and QS (significance at P<0.05).



Scheme of bovine blood pooling to increase antigen exposure with porcine blood samples during *in vitro* crossmatching.

1-12 = Bovine Subjects



RESULTS

For bWB and pWB, agglutination was observed in 9.4% of CMMa and 100% of CMMi via SSA. Incompatibility on CMMa of bWB was more frequent with porcine blood type"0" (P = 0.0107) than with type"A", whereas porcine blood group had no effect on CMMi results. All canine-to-porcine CMMa were incompatible with SSA and showed hemolysis severe enough to prevent evaluation of agglutination. The accuracy of QS at detecting incompatibilities was 87.5% in CMMa and 98.4% in CMMi in bovine-to-porcine samples. Agreement between SSA and QS methods was fair (k = 0.36) for bovine-to-porcine CMMa but could not be calculated for CMMi due to lack of compatible matches. Because all canine-to-porcine CMMa were incompatible, the effects of the porcine blood group on incompatibility, accuracy of QS, and agreement between SSA and QS could not be calculated for CMMa. For CMMi, the agreement between tests was poor (k = 0).

DISCUSSION

When a xenotransfusion to a pig is indicated, bWB appears to be suitable based on in vitro CMMa testing, whereas canine blood products are contraindicated for in vivo administration to swine based on absolute CMMa incompatibility and incidence of hemolysis. In vivo studies are needed to elucidate the clinical significance of CMMi incompatibilities. Based on these results, QS cannot be accurately used as a surrogate of SSA in pretransfusion testing for porcine patients due to the increased risk of false compatible results as QS can only be identified as agglutination, not hemolysis.

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