

Evaluation of isolated caprine pancreatic islets cytoarchitecture by laser scanning confocal microscopy and flow cytometry

ABSTRACT

Background: Pancreatic islets are composed of different hormone-secreting cell types. A finely balanced combination of endocrine cells in the islets regulates intraportal vein secretions and plasma nutrient levels. Every islet cell type is distinguished by its specific secretory granule pattern and hormone content, endocrine and cell signaling mechanisms, and neuronal interactions. The scarcity of pancreatic islet donors for patients with diabetes has caused a considerable interest in the field of islet xenotransplantation. Previous studies have shown that cell arrangement in the pancreatic islets of ruminants differs from that of other mammals; however, caprine islet cytoarchitecture has not yet been comprehensively described. This investigation aimed to characterize caprine islets in regard to better understanding of caprine islet structure and compare with previously reported species, by conducting a detailed analysis of islet architecture and composition using confocal microscopy and immunofluorescence staining for pancreatic islet hormones.

Methodology: After collection and purification of caprine islets with Euro-Ficoll density gradients, islets were considered for viability and functionality procedures with DTZ (dithizone) staining and GSIST (glucose-stimulated insulin secretion test) subsequently. Batches of islet were selected for immunostaining and study through confocal microscopy and flow cytometry.

Results: Histological sections of caprine pancreatic islets showed that β -cells were segregated at the periphery of α -cells. In caprine islets, β - and δ -cells remarkably were intermingled with α -cells in the mantle. Such cytoarchitecture was observed in all examined caprine pancreatic islets and was also reported for the islets of other ruminants. In both small and large caprine islets (< 150 and > 150 μ m in diameter, respectively), the majority of β -cells were positioned at the core and α -cells were arranged at the mantle, while some single β -cells were also observed in the islet center. We evaluated the content of β -, α -, and δ -cells by confocal microscopy (n = 35, mean \pm SD; 38.01 \pm 9.50%, 30.33 \pm 10.11%, 2.25 \pm 1.10%, respectively) and flow cytometry (n = 9, mean \pm SD; 37.52 \pm 9.74%, 31.72 \pm 4.92%, 2.70 \pm 2.81%, respectively). Our findings indicate that the caprine islets are heterogeneous in cell composition. The difference could be attributed to species-specific interaction between endocrine cells and blood.

Conclusions: Comparative studies of islet architecture may lead to better understanding of islet structure and cell type population arrangement. These results suggest the use of caprine islets as an addition to the supply of islets for diabetes research.

Keyword: Caprine islet; Cell composition; Confocal microscopy; Cytoarchitecture; Flow cytometry