

# Comparing Various Preservation Solutions in Bovine Liver Samples: Histopathologic Evaluation of Hepatocellular Changes

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## I. ABSTRACT

Liver tissue for transplant is unviable for many patients as a result of hepatocellular damage during transport [4]. Standard cold storage, the usual method of transport has been shown in multiple studies as early as the 1990's to be ineffective in preserving hepatic tissue for long periods of time [6]. This study examines the efficacy of three alternative preservation solutions, namely lactated Ringer's solution, University of Wisconsin solution, and multivitamin infusion, in bovine liver tissue. Cells are analyzed under a microscope for signs of hypoxic and hypoxemic degeneration such as vacuolation, neutrophilic infiltration and coagulative necrosis. Lactated Ringer's solution showed the least amount of hepatocyte damage after six hours of preservation. This study serves as a pilot study for future experiments in which feasibility of lactated Ringer's solution as a viable human liver transport preservative is analyzed.

## II METHODS AND RESULTS

Standard hematoxylin and eosin (HE stain) was used to color all samples, as per Todo methodology [5]. Light microscopy was performed under a 400x visualization field. Hepatocellular changes were noted by vacuolation (formation of fluid filled pockets in the cell), neutrophilic infiltration (movement of white blood cells) and coagulative necrosis (cell death). Quantitative data were collected using a morphology modification rating system: percentages of vacuolation, neutrophilic infiltration and necrosis were noted via number of altered cells per 100 hepatocytes. A standard hemocytometer was used to assess the microscopic field quantitatively (Allows the measurement of cell numbers). Percentages of each change are recorded in table I. Microscopic analysis of bovine liver tissue submersed in cold lactated Ringer's solution showed minimal histopathological alterations. Only 5 out of 100 hepatocytes demonstrated vacuolation. Neutrophilic infiltration was also minimal; no necrotic cells were visualized.

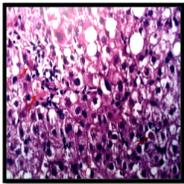


Figure 1: Widespread necrosis in multivitamin infusion solution noted by pyknotic, hyperchromatic nuclei and intensely eosinophilic cytoplasm.

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Solution	Histologic Modification per 100 hepatocytes		
	Vacuolation (%)	Neutrophil Infiltration (%)	Necrosis (%)
Initial Section	1 %	0%	0%
L.R.S	5%	1%	0%
U.W. S	10%	3%	0%
S.C.S.	35%	8%	2%
M.V.I.	50%	12%	6%

TABLE I. HISTOLOGIC ALTERATIONS AND RELATIVE PERCENTAGE

Table 1: Modifications and relative percentage per 100 hepatocytes in various solutions. Abbreviations: L.R.S. Lactated Ringer's solution, U.W.S. University of Wisconsin Solution, S.C.S. Standard Cold Storage, M.V.I. Multivitamin Infusion

## CONCLUSIONS

The results of this study demonstrate that lactated Ringer's solution is the best tissue preservative method in *ex vivo* bovine liver. Hepatocellular damage in lactated Ringer's solution was minimal: hydropic vacuolation was almost inexistent as electrolyte exchanges between interstitial fluid and the Ringer's solution kept osmotic interchanges normal. In future studies, the experimental group pool should be expanded to encompass multiple livers in order to better appreciate statistical figures. Lactated Ringer's solution should also continue to be studied for macro- and micro-induced cellular changes.

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