



ISAKOS
CONGRESS
2023



Boston
Massachusetts
June 18–June 21

Safety Of Single Intra-Articular Local Anesthetic Infusion In Knee Arthroscopy: An In Vivo Histological Study On Rat Cartilage

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Disclosures

I have no financial interests or relationships to disclose.

Introduction

- Local anesthetics & arthroscopy
 - Procedures under local anesthesia¹
 - Post- op pain management²
- Major clinical evidence of toxicity
 - Pain pumps / post op constant effusion of local anesthetics
 - Mostly glenohumeral joint³
 - Knee joint also affected⁴

Toxicity of non continuous effusion

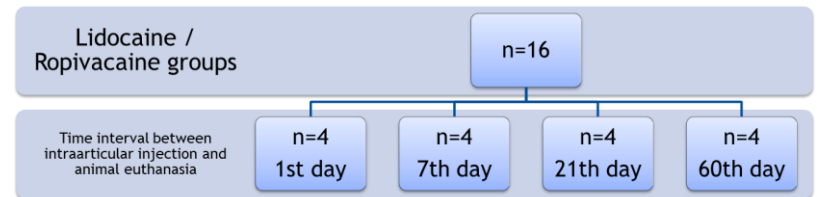
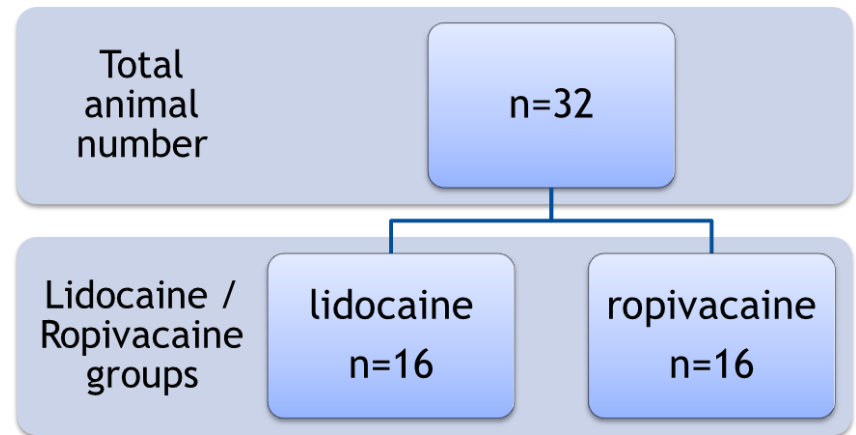
- Studies supporting toxic effects
 - Inflammation⁵
 - reduced number of living cells⁶
- Studies showing no toxicity
 - No significant difference from placebo⁷
 - Same potential from cells received for autologus chondrocyte cultivation under local or spinal/general anesthesia⁸
- Lack of consensus in vivo

Objectives

- Intra-articular injection of
 - Lidocaine 2%
 - OR
 - Ropivacaine 0.75%
- In vivo
- Detect possible toxic effects at different time intervals after injection
- Null hypothesis “there is no histological difference on the cartilage after injection of either local anesthetic or normal saline (placebo)”
- Compare the less toxic ropivacaine with lidocaine

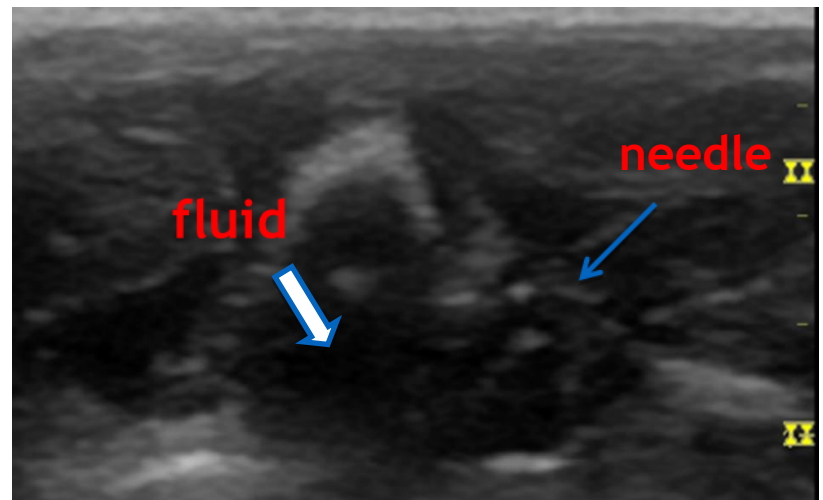
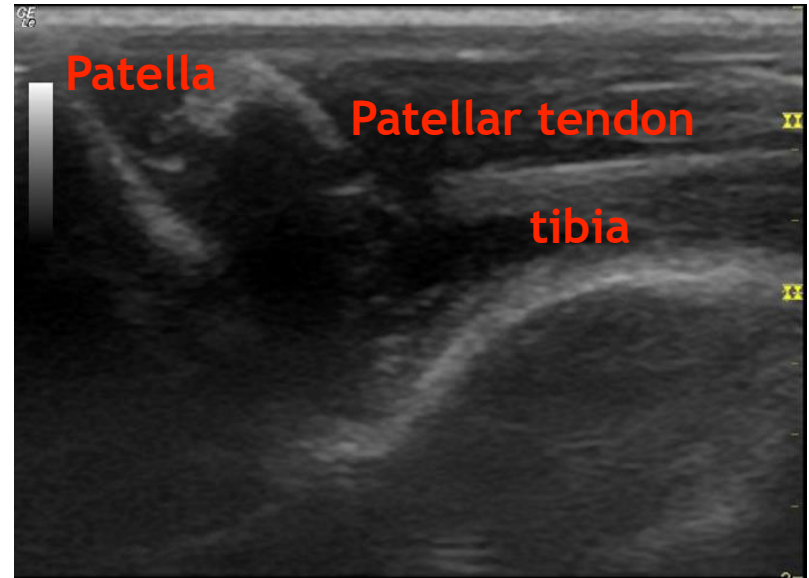
MATERIALS AND METHODS

- 32 Sprague-Dawley rats weighting 250 g
- Two groups of 16 (lidocaine group / ropivacaine group)
- Intra-articular injection at the left knee of
 - 0.2 ml of lidocaine 20mg /ml (16mg/kg) **OR**
 - 0.2ml of ropivacaine 7.5mg/ml (6mg/kg)
- Equal amount of N/S (0.2ml) at the right knee
 - Placebo
- Animals of both group humanely sacrificed at days at days 1, 7, 21, 60



MATERIALS AND METHODS

- Animals anesthetized by IM ketamine (8mg/Kg)
- Povidine /alcoholic solution for skin preparation
- 29 G needle – parapatellar approach
- US guidance (GE Healthcare LOGIQ)



MATERIALS AND METHODS

- Animals euthanasized 1,7, 21 & 60 days after IA injection (ketamine 30 mg/kg)
- Knees resected – soft tissue removed
- Specimens were placed in 10% buffered formalin
- Decalcification / Insertion in paraffin
- Sliced in microtome
- Stain (Haematoxyline Eosine, proteoglucon stainin Safranin 'O')
- Examination at light microscope

MANKIN

Histology Histopathology Grading System

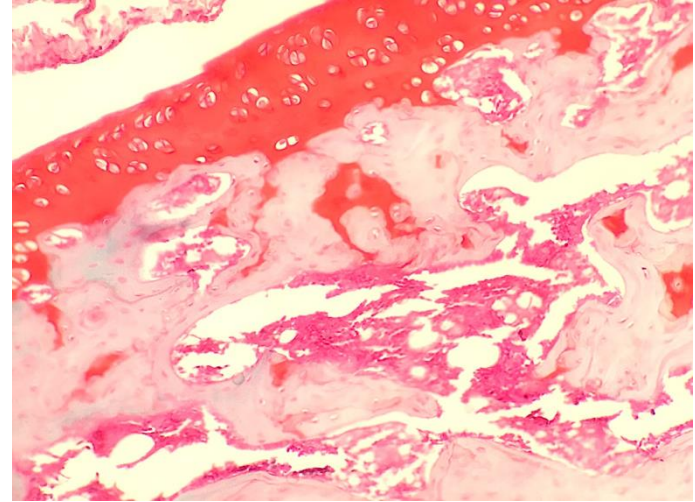
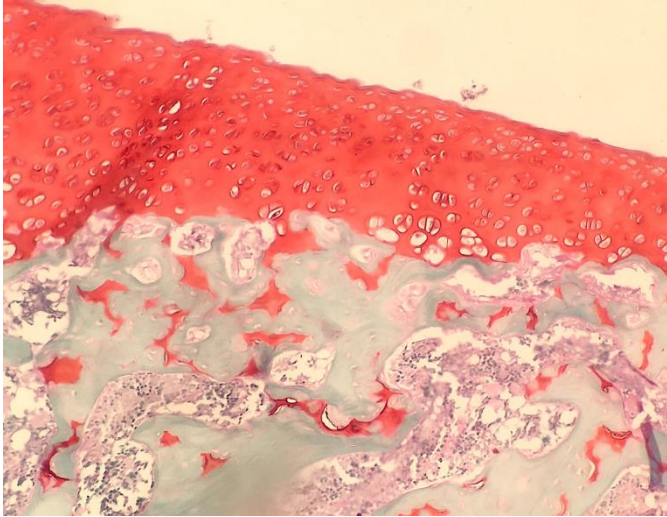
<i>Structure</i>	<i>Score</i>	<i>Proteoglycan Staining</i>	<i>Score</i>
Normal	0	Normal	0
Surface Irregularities	1	Slight Reduction	1
Pannus	2	Moderate Reduction	2
Cleft to Transitional Zone	3	Severe Reduction	3
Cleft to Radial Zone	4	No Dye Noted	4
Cleft to Calcified Zone	5	<i>Cellularity</i>	
Complete disorganization	6	Normal	0
<i>Tidemark Integrity</i>		Diffuse Hypercellularity	1
Intact	0	Cloning	2
Crossed by Blood Vessels	1	Hypocellularity	3

HHGS: Sum of structure, cell, Safranin O stain and Tidemark integrity

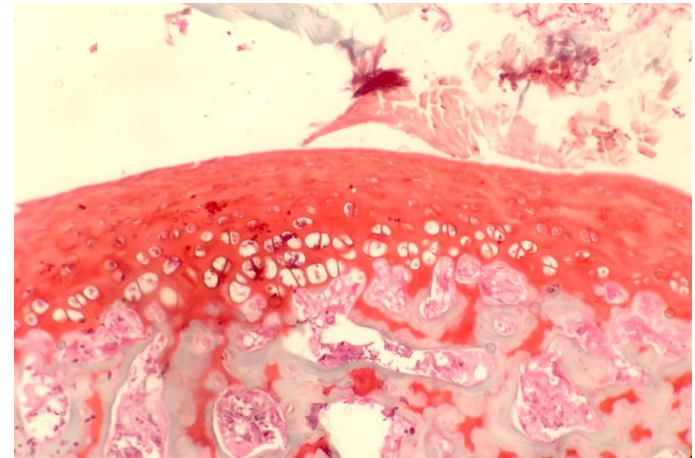
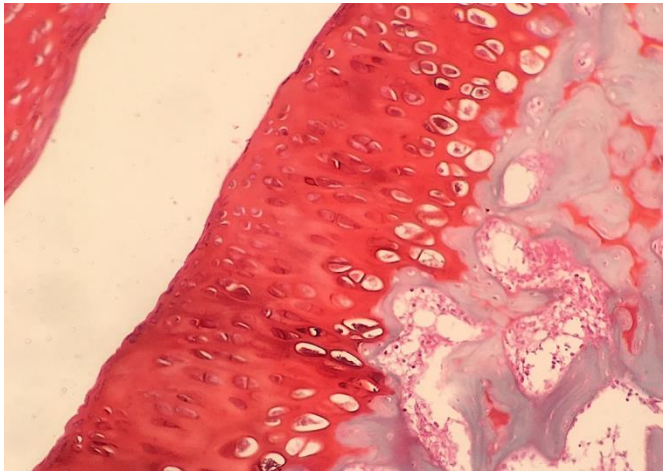
– lidocaine 20mg /ml (16mg/kg)

– ropivacaine 7.5mg/ml

Left Knee



Right Knee



Safranin O Stain for cartilage proteoglycan evaluation (20X):
no significant differences between the animal groups

Statistics

- Non parametric Mann – Whitney U test
- Comparison of
 1. Left knee (tested) vs Right Knee (placebo)
 2. Left Knee of Lidocaine group ns Left knee of ropivacaine group
- Significance level: .05

Results

- No Significant difference between HHGS of lidocaine and placebo (N/S) IA injection at 1,7,21 & 60 days after infusion
- No Significant difference between HHGS of ropivacaine and placebo (N/S) IA injection at 1,7,21 & 60 days after infusion
- No Significant difference between HHGS of ropivacaine and lidocaine IA injection at 1,7,21 & 60 days after infusion

Discussion -limitations

- From pain pumps IA effusions => dose related
- Most evidence of toxicity from in vitro studies (cell cultures)
 - In vivo => dilution from joint fluid
 - Integrity of articular surface⁹
- More sensitive methods for cartilage damage
 - Cell count
 - PCR for agrecan II / collagen expresion
 - Mankin score: subjective – semiquantitative method of evaluation

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