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Postmortem human dura mater mast cells: an experimental study of cellular viability

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Introduction
Dura mater mast cells play an important role in the neuroinflammatory mechanisms associated with primary headaches. However, human experimental models for studying these cells remain limited. Evaluating their postmortem viability and functionality under ex vivo conditions may expand opportunities to investigate the pathophysiological mechanisms underlying headache disorders.

Objective
To evaluate the preservation of cellular viability and the granulation/degranulation capacity of mast cells from postmortem human dura mater maintained in culture medium during the experimental postmortem period.

Methods
This quantitative study was conducted at the Death Verification Service of the Federal University of Pernambuco (UFPE), Brazil. Dura mater samples were collected near the left middle meningeal artery from two female cadavers at 9 and 12 hours postmortem, respectively. Twelve tissue samples measuring 1 × 1 cm were obtained from each dura mater specimen and incubated in Dulbecco's Modified Eagle Medium (DMEM). Samples were allocated into six experimental groups (0 h, 5 min, 30 min, 1 h, 2 h, and 24 h), with two samples per group. Samples from the 0 h group were not incubated; they were washed twice in synthetic interstitial fluid (SIF) for 5 min and then fixed in 10% buffered formalin. The remaining samples underwent the same SIF washing procedure, followed by incubation in DMEM for the respective experimental periods, a further SIF wash, and fixation in 10% buffered formalin. Subsequently, tissues were processed using standard histological procedures, sectioned at 4 µm, mounted on histological slides, stained with 0.1% toluidine blue, and analyzed under light microscopy at 400× magnification for quantification of granulated and degranulated mast cells.

Results
Granulated and degranulated mast cells were observed at all experimental time points, with a predominance of degranulated cells. At baseline (0 h), 29.23% (n=19/65) of mast cells were granulated, and 70.77% (n=46/65) were degranulated. At 5 min, 30 min, and 1 h, the proportion of granulated mast cells decreased to 11.30% (n=26/230), 11.28% (n=15/133), and 8.62% (n=5/58), respectively, whereas the proportion of degranulated mast cells increased to 88.70% (n=204/230), 88.72% (n=118/133), and 91.38% (n=53/58), respectively. After 2 h of DMEM exposure, 24.60% (n=31/126) of mast cells remained granulated, and 75.40% (n=95/126) were degranulated. After 24 h, the granulation rate decreased again to 9.84% (n=31/315), while the degranulation rate increased to 90.16% (n=284/315).

Conclusion
The findings demonstrate preservation of the morphological characteristics and granulation/degranulation capacity of human dura mater mast cells for up to 24 hours following incubation, supporting the potential of this model for ex vivo experimental studies. Further investigations, including a larger number of samples and specific cellular viability markers, are necessary to confirm these findings.

Keywords:
Neuroinflammation
Dura mater
Mast cells
Cellular degranulation

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