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Transplantation of Human Neural Stem Cell in Rat Model of Acute Subdural Hematoma

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Introduction

Acute subdural hematoma (ASDH) commonly associated with grave prognosis with high rate of morbidity and mortality. Both emergent surgical evacuation of hematoma and optimal medical management are utilized to alleviate high intracranial pressure during acute phase of injury. No effective treatment strategies are available for long term disability and cognitive changes. Neural stem cell transplantations have emerged as putative therapeutic approaches. In this rodent study, we evaluated the engraftment of human fetal neural stem cells (hNSC) in a rat model of ASDH.

Methods

10 Sprague-Dawley athymic rats underwent a unilateral induction of ASDH followed by craniectomy and hematoma evacuation. hNSC was made GFP expressing in vitro prior to grafting. At 1 week post injury, animals were randomized into 2 groups and underwent placement of 1)hNSC embedded in collagen matrix 2)collagen matrix only (control)on prior hematoma site. Animals were sacrificed at 2-week and 8-week post hNSC grafting for further analysis.

Results

There was 30% mortality rate associated with general anesthesia and ASDH. For those survived, GFP -expressing hNSC was visualized penetrating through the pia and sending human axons and neuronal processes to the ASDH perilesional region. These grafts gradually matured and expressed predominantly neuronal marker. No overgrowth of undifferentiated cells/teratomas was observed.

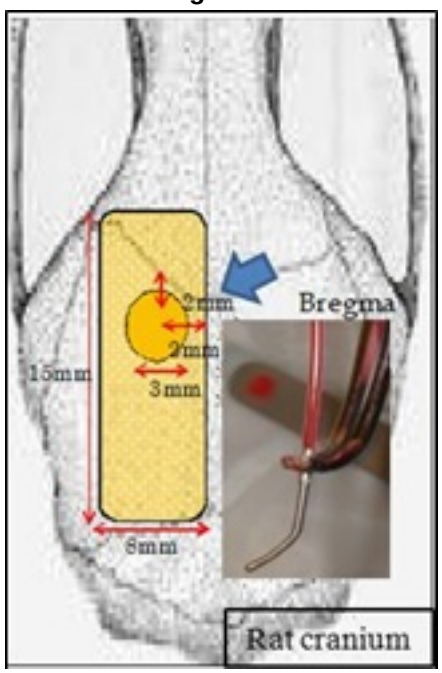
Conclusions

In our study, engraftment of hNSC with aid of collagen matrix was observed up to 8 week post transplantation. This procedure maybe translatable during routine cranioplasty after craniectomy in human. We are currently determining whether transplantation results in functional improvement.

Learning Objectives

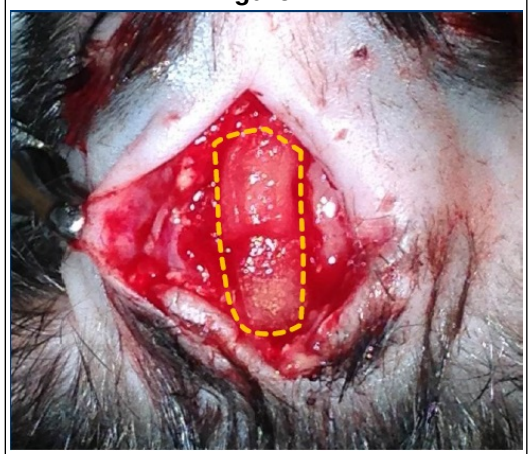
1) To demonstrate the survivalability of hNSC conducive to engraftment in a rat model of ASDH
2) To demonstrate whether these hNSC able to differentiate in neurons

figure 1



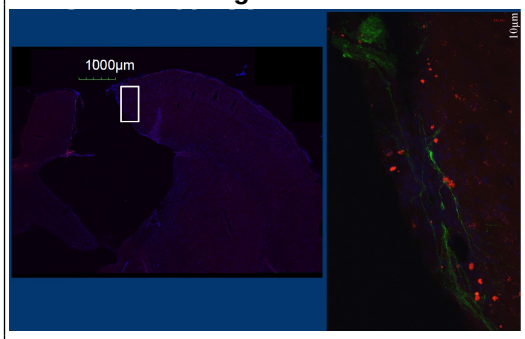
ASDH induction

figure 2



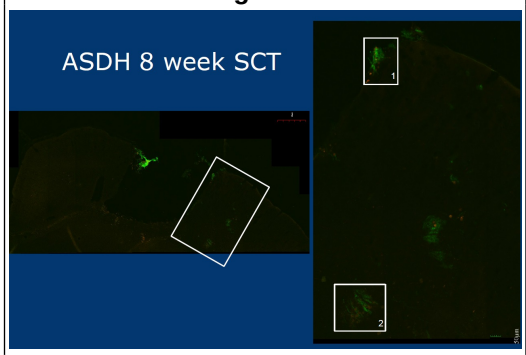
ASDH with collagen matrix + hNSC (also used as dural substitute)

figure 3



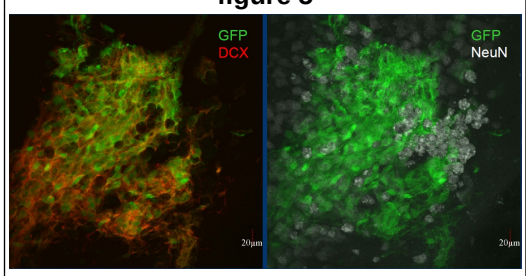
hNSC penetrate through pia and migrate into cortical parenchyma near the cavitation caused by hematoma

figure 4



distribution of neuronal processess beneath the SDH cavitation

figure 5



The GFP+ hNSC expressing NeuN (neuronal marker)