Session: Imaging (diagnosis & treatment)

REDUCED WHITE MATTER INTEGRITY AT SPLENIUM OF CORPUS CALLOSUM CONNECTING TO SOMATOSENSORY CORTEX IN ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) COMPARED WITH NORMAL CONTROL – A CEREBRAL DIFFUSION TENSOR IMAGING (DTI) STUDY

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Introduction: Increasing evidence shows the possibility of an underlying neurological disorder for adolescent idiopathic scoliosis (AIS), such as the disturbed somatosensory functions. In this study, we examined the cerebral white matter fiber bundles in AIS using diffusion tensor imaging (DTI), a magnetic resonance imaging (MRI) technique to measure the white matter integrity, e.g. fiber density, and myelinization in white matter reflected by the fractional anisotropy (FA). We will focus in the largest white matter fiber bundles, corpus callosum (CC) which is acting as a bridge to link the two hemispheres of the brain (left and right) because morphological changes in CC have been reported by our group previously [1].

Subjects and Methods: Thirty three AIS patients (girl, right thoracic curve, age 14.9 ± 1.4) and thirty age-matched normal control (NC) (girl, age 14.7 ± 0.9) underwent DTI along 32 non-linear directions using a 3T MRI scanner. 3D segmentation of the CC was performed semi-automatically using ITK-SNAP 2.4, followed by regional segmentation of the CC using a well-known CC template, Witelson, et al. template.

Results: In the 3D segmentation, significantly lower mean FA values of the genu of the CC interconnecting the prefrontal cortex and splenium of the CC interconnecting somatosensory cortex were found in AIS patients compared to those in normal control (p < 0.001), while the other regions also showed a lower FA value in AIS though have not yet reached statistical significance.

Discussion and Conclusion: Generalized lower FA values in CC of the AIS patient indicates that there is a reduced white matter integrity of CC, in particular the genu and the splenium of the CC fibers interconnecting the prefrontal cortex, as well as the somatosensory cortex respectively. This coincides with our clinical observation of significantly prolonged latency of somatosensory evoked potentials (SEP) over the somatosensory cortex on the side of the major curve [2]. Along with our previous study which showed a reduction of white matter integrity within major fibers connecting to somatosensory cortex in AIS.

References


at six months after the biological treatment were identified to be significant fac-
tors predicting destruction of the large joints at two years.

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SYNTHESIS AND CHARACTERIZATION OF AN HSP27-TARGETED NANOPROBE
FOR IN VIVO PHOTOACOUSTIC IMAGING OF EARLY NERVE INJURY
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Objective: Imaging is routinely used for clinical and diagnostic purposes, but tech-
niques capable of high specificity and resolution for the early detection of nerve
injury are still limited. Photoacoustic imaging (PAI), a novel imaging modality
that combines the merits of laser and ultrasound, offers high contrast, high reso-
lution, and satisfactory tissue penetration. So we aim to exploit the novel PAI with
functionalized targeted probe for detection of early nerve injury.
Methods: After the sciatic nerve was crushed, Western blot observed that the
expression level of heat shock protein 27 (HSP27) upregulated within 3 to 7 days
of nerve injury. HSP27 was used as a specific marker for early nerve injury, we con-
jugated gold nanorods (GNRs) to HSP27-specific antibodies to generate a nanop-
robe as GNR-HSP27Abs. The spectroscopy and zeta potential detected the
characterization of GNR-HSP27Abs. The non-targeting GNRs or targeting GNR-
HSP27Abs were injected into the site of nerve injury 3 and 7 days after surgery.
Results: HSP27 was weakly expressed in the intact sciatic nerves in uninjured an-
imals. After nerve injury, HSP27 expression increased significantly in the injured
erve. The absorption spectroscopy, fluorescence spectroscopy, FTIR spectroscopy
and zeta potential confirmed that the HSP27Abs was well-coupled to GNRs and was
indicative of successful nanoprobe synthesis. In vitro and in vivo PAI acquired 12
hours after local administration of GNR-HSP27Abs demonstrated that the nanop-
robe can distinguish between injured and uninjured nerves in rats. The toxicity
assay results showed no cytotoxicity against human cell lines and no such inflam-
atory reactions occurred in these injection regions.
Discussion: High expression of HSP27 in early nerve injury was confirmed by our
experiments. GNRs-HSP27Abs as molecular targeted probes possess a high absorp-
tion peak at the NIR wavelength, which allows for imaging with deeper penetration
of laser light and lower intrinsic background noise. Due to the high optical absorp-
tion and targeting efficiency of GNRs-HSP27Abs, PAI was successful in detecting
early nerve injury within 3–7 day. The toxicity test results revealed that a single
imaging dose of GNRs or GNRs-HSP27Abs provided satisfactory biosafety for clinical
application.
Conclusion: Taken together, these findings expand the application of nanoprobe-
targeted PAI to the detection of injured nerves, and prompt further development
of this novel imaging platform for clinical application.
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