Embryonic stem cells in human sacrococcygeal teratomas: Isolation and characterization of an embryonic stem cell line

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Introduction:
Teratomas are benign tumours derived from pluripotent embryonic stem cells and contain a variety of organ structures. Sacrococcygeal teratomas (SCTs) are the most frequent solid tumours of the newborn with an incidence of approximately 1:35,000. To find a novel source for human embryonic stem cells, SCTs were examined.

Materials and Methods:
1. A histological survey was performed on 20 SCTs. 2. Tissue from a SCT of a newborn girl was obtained intra-operatively. After generation of a cell suspension, cells were expanded in selective media to facilitate the cultivation of stem cells contained therein. After a few cell passages, a homogeneous population of stem cells was isolated.

Results:
1. Histological analysis of the 20 SCTs revealed that in particular, caudal tissues (Fallopian tube, vaginal epithelium) and the outgrowth of pancreatic tissue with islets from colonic crypts were encountered in 50% of cases. Stem cells were successfully demonstrated in paraffin sections by using nanog, Oct4, SSEA-4, and nestin antibodies.

2. Immunofluorescence and RT-PCR analyses revealed that the isolated cells were positive for nanog, Oct4, SSEA-4, and Stella, and thus showed traits of embryonic stem cells. The isolated stem cells spontaneously grew as spheroids. First differentiation assays showed that \textit{in vitro} the cells were able to differentiate into astrocytes and neurons. After transplantation of the spheroids into the neural tube or the brain vesicles of the 2 day chick embryo, the cells integrated into the neural crest and into the embryonic brain, respectively. Further \textit{in vivo} and \textit{in vitro} characterization of the stem cells is under way.

Discussion:
Sacrococcygeal teratomas represent a novel source for human embryonic stem cells.