**Introduction** The National Acute Spinal Cord Injury Study (NASCIS) recommends megadose corticosteroid treatment in the case of spinal trauma (1). Vertebral aseptic osteonecrosis often is associated with high dose glucocorticoid treatment (2). Reduced blood flow is assumed to be the pathomechanism. The objective of this study was to investigate if megadose corticosteroid application modulates spinal blood flow in an awake animal model.

**Materials and Methods**

**Study design** Two 18 immature female domestic pigs (80 kg bodyweight) from 9 litters, 9 animals were randomly allocated to CS treatment while their 9 sister pigs served as controls. Drug or placebo was applied blindly by a third person not involved in the study.

**Preparation** In intravenous propofol anesthesia, sheaths were placed in one carotid artery (7F) and in one jugular vein (6F). A 6F angiographic catheter was advanced into the left ventricle under X-ray control through the sheath in the carotid artery. After closure of the operation site, anesthesia was stopped, the animal transferred into a cage, and allowed to awake fully.

**Corticosteroid (CS) treatment** According to the NASCIS spinal trauma treatment scheme, methylprednisolone or placebo was administered into the jugular vein of the awake pig; 30 mg/kg of bodyweight methylprednisolone over a 15-minute period, followed by a 45-min. pause, maintained over 23-hours at a dose of 5.4 mg/kg bodyweight/hour (1).

**Blood Flow Measurement** 15 μm microspheres (New England Nuclear, Boston, MA) labelled with the isotopes Tm (phase 1), Ruthenium (phase 2), and Cerium (phase 3) were injected into the left ventricle in phase 1 before, in phase 2 one hour after, and in phase 3 twentyfour hours after starting the methylprednisolone administration (3). Reference blood sampling was done in the aorta. After killing the pig with pentobarbital injection, the T12, L1, and L2 vertebrae and spinal medulla were removed in toto from the cadaver. T12 to L2 endplates, cancellous bone, cortical shell, discs, grey and white matter, and nerve roots were separately filled into counting vials. Reference blood samples and tissue samples were counted for gamma activity (Packard Cobra, Packard Instrument Co., Meriden, CT) relating to each sphere type using spectral analysis. Correction for cross-talk, background, and decay during counting was performed. Regional blood flow (RBF) was calculated from the gamma activity data (3) as

\[
RBF = \frac{[C(Biopsy)]*SR*100}{[W(Biopsy)]*[C(Ref)]}
\]

where [C(Biopsy)] denotes the count rate of a predefined region (counts per minute), [C(Ref)] the count rate of the reference blood sample from the aorta, SR the sampling rate of the reference blood sample, and [W(Biopsy)] the weight of the biopsy.

**Evaluation** Raw data were documented to be normal distributed by q-q-plotting, and homogeneity of variances was documented by the Levene’s test. The parameters in the two experimental groups could thus be compared by independent samples t-test.

**Essential results** Two CS pigs were not injected microspheres, one because of clotting of the heart catheter and another died under anesthesia. In the control group, samples of one pig were not counted, because of counter unavailability, and the phase 3 RBF in one pig was excluded because of clinical symptoms of mesenterial artery emboly prior to MS injection. In the CS group, the phase 3 RBF in one pig was excluded because the animal had damaged the infusion line resulting in drug leakage. The phase 2 RBF in one CS animal was lost due to catheter occlusion.

In all subregions of the vertebral bone and spinal medulla samples, no significant difference in RBF was found between groups in phase 1, and no significant change in blood flow occurred during corticosteroid application in phases 1, 2, and 3 (Table 1).

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**Discussion** The spinal blood flow data of the present study are comparable to those obtained in other studies in pigs (5). The above experimental data show no acute change in osseous or nervous spinal tissue blood flow in the segments investigated in the awake, normal pig under megadose corticosteroid application as recommended by NASCIS. This result is concurrent with a clinical study in which treatment with the NASCIS spinal trauma treatment scheme did not result in a case of femoral or humeral osteonecrosis (6). However, 3month methylprednisolone treatment in pigs resulted in vertebral endplate and cancellous bone blood flow reduction (3) and hypercoclusitability of blood (4). This suggests that not the single corticosteroid megadosage application as used according to NASCIS but rather the longer term corticosteroid application modulates vertebral blood flow and may lead to vertebral osteonecrosis.

**References**