INTRODUCTION:
Today, the surgeon has to choose between cemented and cementless fixation of total hip replacement. The results of the Swedish registry after a follow-up of 10 years showed comparable results with both techniques, a correct indication and implantation assumed[1]. Thrombembolic complications, which include the fat embolism syndrome, are well known consequences of cementless and cemented femoral total hip replacement[2]. Thrombembolic phenomena could be demonstrated clinically and experimentally with both fixation techniques[3,4]. The aim of our study was an exact quantification of the intravasated fat emboli with both fixation techniques in an in vivo animal model.

METHODS:
We simulated in 15 merino sheep the simultaneous, bilateral implantation of a cemented and a cementless prosthesis and collected the drained blood by catheters in the external iliacal veins (Fig.1). The femur was prepared for the insertion of a custom-made prosthesis using a lateral approach to the hip joint. We additionally inserted a gelatin cement restrictor (IMSET, Aesculap, Germany) on the cemented side and the femoral canal was cleaned with 250 ml Saline using a pulsatile lavage. We shortly opened the venous catheters after bone preparation and collected the blood in 50 ml tubes for the fat analysis. Then we simultaneously implanted on one side a cemented and on the other side a cementless fixed prosthesis and opened the catheters again (Fig. 1). We performed a quantitative fat analysis of the collected blood and the composition of the extracted fatty acids was further analyzed in selected samples by gas chromatography.

RESULTS:
Two animals had to be excluded because the blood flow from the catheter in the external iliac vein ceased shortly after implantation on the cemented side and therefore did not allow for sufficient blood collection. In all other animals the blood samples on the cemented side contained significantly higher amounts of fat (mean: 2.27 g) than on the cementless implanted side (mean: 1.16 g) (p=0.0002). To evaluate the influence of the bone preparation on the risk for fat embolism we collected the first three samples after femoral preparation and prior to implantation. All samples of each sheep on the cemented side contained nearly the same amount of fat. The results were different on the cemented side (Fig.2). 10 of 13 animals showed one or more characteristic peaks of fat intravasation. The samples 1-3 correspond to samples collected after preparation of the intramedullary canal – and after cement restrictor insertion. 8 of 10 sheep showed at least one characteristic peak in these early collected samples. From sample 4 the peaks were caused by cement and stem insertion.

DISCUSSION:
Our study revealed a significant difference in the amount of fat intravasation into the blood stream with the cemented compared to the cementless implant fixation. The preparation of the femoral canal with the cementless fixation technique seems to be of minor importance concerning the risk of fat embolism, although the risk for thrombembolic complications still exists. Because of the higher risk during cemented implantation the application of a cement restrictor, cement and a prosthesis should be performed with special care. Because of the study design, peaks in fat intravasation during the first three samples were caused by cement restrictor insertion. The plug insertion resulted in 8 of 13 sheep in a significant amount of intramedullary fat displacement. Therefore the cleaning of the bone by pulsatile lavage should be performed prior to cement restrictor insertion and always prior to cement application in order to reduce the amount of fat and bone marrow and to increase cement penetration into cancellous bone[5].