Introduction
During the ILTS 2008 meeting in Paris, France, I presented my abstract “Is Roux-Y Choledochojejunostomy an Independent Risk Factor for the Development of Non-Anastomotic Biliary Strictures after Liver Transplantation?” in the session Surgical Techniques / Complications II. It was a very lively and interactive session. The main point of discussion was surgical complications of the bile ducts. Anastomotic and non-anastomotic strictures are major complications after human liver transplantation and their pathogenetic mechanisms are emerging. Beside preservation related and immunological injury, bile salts seem to play a major role in the occurrence of hepatobiliary injury.

NAS, PSC and Roux-Y choledochojejunostomy
Non-anastomotic biliary strictures (NAS) are a serious complication after orthotopic liver transplantation (OLT), found in up to 19% of the patients. As already mentioned above, the exact pathogenesis remains unknown. Apart from hepatic artery thrombosis, NAS is associated with preservation-related risk factors as well as immunological processes, such as primary sclerosing cholangitis (PSC). PSC is a chronic hepatobiliary disease of unknown aetiology, characterized by diffuse fibrosing inflammation of the intra- and
extrahepatic bile ducts. No effective medical treatment is available and OLT is the definitive treatment for patients with end-stage PSC. Moreover, involvement of the common bile duct in PSC patients usually makes it necessary to construct a Roux-Y choledochojunostomy during OLT. In our experience, however, duct-to-duct anastomosis is also possible in selected patients with a disease free extrahepatic bile duct. Previously, duct-to-duct anastomosis is reported to be safe and efficacious when used in patients with PSC undergoing OLT. In accordance with previous studies, we recently reported a higher incidence of NAS in patients transplanted for PSC, as well as more frequent occurrence of NAS in patients with Roux-Y choledochojunostomy reconstruction, compared with duct-to-duct anastomosis. Roux-Y choledochojunostomy reconstruction was used more frequently in patients transplanted for PSC, compared with patients transplanted for other indications. However, it remained unknown whether PSC and Roux-Y choledochojunostomy are independent risk factors for the development of NAS, or whether this is an epiphenomenon. Most likely, Roux-Y choledochojunostomy mimics bacterial reflux of bacteria into the biliary tree (ascending cholangitis) as has been shown in animal models. Hence, the aim of our study was to identify whether PSC and Roux-Y choledochojunostomy are independent risk factors after multivariate analysis for development of NAS. We described the occurrence of NAS in a large cohort of liver transplantation recipients with long-term follow-up. During 17 years more than 700 OLTs were performed in our center. After exclusion of children and patients with NAS caused by hepatic artery thrombosis, almost 500 transplantations in adult patients were included in our study. Follow-up was until the end of 2005 with a minimal follow-up time after transplantation of 2.5 years.

PSC is an independent risk factors for NAS
It turned out that only PSC is an independent risk factor multivariately, for developing NAS after liver transplantation. Irrespective of PSC, our results
demonstrated an equal incidence of NAS in patients with Roux-Y choledochojjunostomy, compared with patients with a duct-to-duct anastomosis. Despite a 4-times higher incidence of ascending cholangitis in patients with Roux-Y reconstruction, the type of reconstruction is not of influence for occurrence of NAS in transplanted patients. The cumulative incidence of NAS was almost 17% and this in line with most other studies, although, lower percentages have also been reported in some series. This can be explained by differences in the definition and diagnostics used, as well as differences in duration of follow-up. In accordance, prior investigations have also shown that NAS occur approximately twice as frequent in patients receiving transplants for PSC as in patients receiving transplants for other diseases. The influence of preceding PSC to induce biliary changes of the allograft is highly suspected, however, PSC recurrence remains controversial. The diagnosis of PSC is based on well defined cholangiographic findings; none of these features are specific for PSC, especially following transplantation, because NAS can occur from a variety of causes other than recurrence. Our data are in accordance with others, who found equal distribution of NAS or PSC recurrence in patients transplanted with Roux-Y choledochojjunostomy and duct-to-duct anastomosis. Of interest, they also found significant higher incidence cholangitis in the choledochojjunostomy group, despite equal distribution of NAS. Therefore, bacterial translocation seems not to play a role in the origin of NAS transplanted patients.

Conclusions
Our results demonstrate that PSC is indeed an independent risk factors for the development of NAS. The occurrence of NAS, which was previously associated with Roux –Y reconstruction, is not influenced by the type of reconstruction, despite Roux –Y choledochojjunostomy being a risk factor for recurrent cholangitis with NAS. Bacterial translocation does not play a role in the origin of NAS.