Tumors of the pancreatic head are treated with partial duo-
denopancreatectomy, tumors of the corpus/tail region with a
left-sided pancreatic resection and splenectomy. Because of
consequently arising problems in connection with complete
exo- and endocrinological insufficiency, a total pancreatecto-
my is only indicated when the entire pancreas is involved.

Since isolated resection of the pancreatic tumor could not im-
prove long-term survival, over the last 15 years surgical proce-
dures were extended. Operations including intra- and
retroperitoneal lymphadenectomies were performed. This ex-
tension of the surgical procedure is (among others) based on
the findings of Ishikawa et al. [4], who in 1988 described that
patients with a resectable pancreatic head carcinoma showed
an improvement in the 5-year survival time from 9 to 28%
after radical intra- and retroperitoneal lymphadenectomy.

For our own operative strategy we distinguish between re-
gional and extended retroperitoneal lymphadenectomy. Re-
gional lymphadenectomy includes resection of the pancreatic
head with removal of all lymphatic tissue at the hepatoduode-
nal ligament, the hepatic artery, the celiac trunk, the first 3 cm
of the splenic artery, the right side of the superior mesenteric
artery, and the ventral surface of the vena cava and the renal
veins.

During extended retroperitoneal lymphadenectomy (as de-
scribed by Ishikawa et al. [4]) all lymphatic, connective and
nerve tissues at the aorta between the inferior mesenteric
artery and the coeliac trunk as well as the left side of the supe-
rior mesenteric artery are additionally resected.

not allow a definitive conclusion regarding the prognostic im-
 pact of extended retroperitoneal resection on the prognosis of
the patients. The analysis of the prognostic factors for long-
term survival in our own 72 patients with ductal adenocarcino-
ma of the pancreatic head operated between 1988 and 1998
(regional LA n=26, extended LA n=46) could not demon-
demonstrate a prognostic impact of extended lymphadenectomy on survival, but for patients with early tumor stages (UICC-stage I/II, n=18) a 5-year survival of 63% could be reached. In this group of patients no difference between regional and extended retroperitoneal lymphadenectomy could be observed, so it must be concluded that regional lymphadenectomy positively influences the course of disease in the early stage [6].

A direct comparison with the results of other authors is difficult because the following parameters vary considerably in the different studies:

- The operative procedures (extent of lymphadenectomy, principally performed resection of the portal vein).
- The histopathological analysis and diagnosis (preparation of the resected tissue, number of analyzed lymph nodes, exact localization of the lymphatic tissue, differentiation of the tumor).
- The percentage of ductal adenocarcinoma of the pancreas in the analyzed group of patients.
- The UICC-tumor stages of the patients with ductal adenocarcinoma of the pancreas in the studies.
- The percentage of R0-resected patients.

On the other hand it can not be excluded that the improvement of the 5-year survival rates after extended retroperitoneal lymphadenectomy is based on the phenomenon of “stage migration”. The analysis of a larger number of resected lymph nodes results most likely in a more precise (mostly higher) tumor staging with the following effect: There are no longer patients with a lymph node invasion and thus a more negative prognosis in the stages of patients without invasion. Consequently, the survival rate of this group is improved. Furthermore, there will be an increase of patients with just one positive lymph node (N1a-stage) in the group of patients with positive lymph nodes, thus improving the 5-year survival rate in this group also. Altogether, extended lymphadenectomy seems to lead to an improved prognosis. In reality, however, only a more exact staging exists.

The answer to the question whether and to what extent lymphadenectomy influences the prognosis for patients with ductal adenocarcinoma of the pancreas is principally very important, since radical lymphatic dissection, as described by Ishikawa et al. [4] may lead to considerable postoperative disorders. These can be motility disturbances and, in some cases, long-term diarrhea necessitating hospitalization.

Further study protocols will have to face all these questions in a multicenter study in regard to criteria for surgery, extent of lymphadenectomy and histopathology. In 1998 the International Workshop on Surgical Procedures in Pancreatic Cancer tried to define standards of terminology for the operative procedures and histopathological evaluation [7]. For the surgical approach concerning the extent of lymphadenectomy three types were defined: standard procedure, radical lymphadenectomy and extended radical lymphadenectomy. The extent of the resected lymph nodes was defined according to the Japanese classification, because only there different stations are described in detail. On this basis a multicenter study was initiated, the results of which are still to be expected.

Resection of the Portal Vein

Another open question is the indication for pancreatic head resection in patients with preoperatively diagnosed portal invasion. From the surgeon’s point of view the segmental resection of the portal vein / vena mesenterica superior and their reconstruction do not substantially extend the operation and increase perioperative morbidity and mortality, but the value of the resection regarding long-term survival can not be evaluated so far.

Ishikawa et al. [8] described a 3-year survival rate of 59% in patients with a short infiltration of the portal vein. This is in contrast to other authors and our own experience [6] where even after R0 resection none of the patients with portal infiltration survived longer than 12 months.

The remaining problem is the selection criteria for a curative resection, since imaging procedures might demonstrate a stenosis of the portal vein, but mostly are not able to histologically differ between compression and infiltration. As our own results demonstrate, even intraoperatively, during preparation or even resection, a definitive judgement can be difficult. In 20 of the 72 patients of our group the portal vein was resected and reconstructed, but in only 16 cases an infiltration was proven, while in 4 cases only an inflammation could be found in the histopathological examination.

Because of the difficulty to evaluate a surface wall infiltration and the potential risk of microscopically small residual tumor masses, some Japanese work groups consequently resect the portal vein in every pancreatic resection. This procedure was also described by American authors, namely Fortner [9].

Disseminated Tumor Cells

Quite a number of work groups recently demonstrated that micrometastases and single disseminated tumor cells can be detected by immunocytological and molecularbiological methods, which has not been possible by conventional histological techniques. Single tumor cells can be detected in lymph nodes, bone marrow, blood, peritoneal cavity and in secretory products (e.g. by the gall bladder). The biological relevance of these single cells is not yet clear. Can they proliferate and mutate to metastases? Are they in a resting position with the possibility to proliferate any time? These questions are to be answered.

Vogel and Kalthoff [1] could clearly demonstrate in a survey of more than 80 patients with pancreatic carcinoma that a correlation between detection of single tumor cells and tumor stage exists and that the 5-year survival rate is significantly better for patients without verified micrometastases.
Thus, tumor cell dissemination seems to have a prognostic relevance which has not yet been taken into consideration in the present TNM classification. This will, however, reach great importance for the exact tumor staging and R classification in the future.

The extent of the surgical intervention regarding radical lymphadenectomy will definitely have to be discussed after data on the prognosis factor ‘disseminated single tumor cell’ are available.

**Conclusion**

Tumor resection is presently the only curative treatment option in pancreatic carcinoma.

In some published studies the development of extended surgical procedures (radical lymphadenectomy) resulted in prolonged survival. The effect of the phenomenon ‘stage migration’ remains to be clarified. Meanwhile, the value and extent of the lymphadenectomy necessary for prognosis improvement can not yet be determined.

Our own concept includes a regional lymphadenectomy in all cases. This procedure includes removal of the lymphatic nodes at the hepatoduodenal ligament, the celiac trunk, the first part of the A. lienalis, the right side of the A. mesenterica superior, and the ventral part of the V. cava under preparation of the renal vein junction. The reason for this procedure is an exact staging of the lymphatic nodes, which we send to the pathologist separately. This procedure also minimized the risk of severe postoperative diarrhea because it preserves the left lymphatic tissue of the superior mesenteric artery.

Extended lymphadenectomy with additional resection of the paraaortal lymphatic tissue and the lymph nodes on the left side of the mesenteric artery results in higher postoperative morbidity due to mobility disturbances and diarrhea. An increase in long-term survival due to a higher radicalness so far has not been proven, the risk of reduced quality of life is clearly increased.

Therefore extended resection should only be performed in studies after informing the patient in detail and evaluating the postoperative quality of life.

Even if there remain open questions concerning the extent of surgical intervention, the basic principle of surgical intervention in curative intention persists. R0 resection of the tumor (macroscopically and microscopically no tumor residua) is essential for the chance of long term survival and depends on early tumor stages. R1 and R2 resections clearly have a negative prognosis. Therefore, an extension of the surgical procedure including gastrectomy, colonic resection or resection and reconstruction of major vessels is justified if a total removal of the primary tumor can be achieved.

With advanced tumor stages (and in patients with proven tumor cell dissemination?) resection alone will not lead to improvement of survival and therefore has to be combined with effective adjuvant therapies (chemo-, radio-, immunotherapy) to increase the survival chance of these patients.

**References**