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Informationsportal zu Krebserkrankungen bei Kindern und Jugendlichen

Pancreatic tumours (Brief information)

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KINDER KREBS STIFTUNG

Table of Content

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Both benign and malignant tumours can develop in the pancreas. This, however, happens rarely in childhood and adolescence; in Germany, less than ten children or teenagers are diagnosed with such a tumour per year.

Hence, there are no therapy studies providing the optimal treatment strategy that has been proven for many patients, as there are for other tumours in childhood and adolescence. However, the experts of the Registry for Rare Diseases in Paediatrics (German abbreviation: STEP, for "**S**eltene **T**umor**e**rkrankungen in der **P**ädiatrie") have summarized their experiences as well as the experiences of international research groups on the following pages.

Since every child is different, it is important to individually adjust the treatment to every single patient. Therefore, “STEP” offers free advice via a tumourboard attended by multidisciplinary experts. Feel free to have your attending physician to contact the experts at “STEP” at *step@klinikumdo.de*. Also, by registering your child with the „STEP“ registry, you get the option to help expanding the experience with these rare tumours, thereby helping other children who are diagnosed with such a disease in the future.

The following paragraphs provide information on the most frequent pancreatic tumours in childhood and adolescence.

1. Introduction to the pancreas

The pancreas is located behind the stomach at the level of the kidneys in the upper back of the abdomen. The longish organ has a head and a tail. The head is surrounded by the duodenum.

The pancreas consists of both *exocrine* and *endocrine* gland tissue. The exocrine gland cells are responsible for the production of digestive juices (digestive enzymes), which are secreted into the duodenum via the pancreatic duct. The endocrine tissue contains cell groups that are scattered all over the organ (so-called Langerhans islets). These produce the *hormone*s *insulin* and *glucagon*, which control blood sugar levels.

2. Pancreatoblastoma

Pancreatoblastoma is an *embryonal*, malignant tumour of the pancreas, which is very rare. Recently, a total of 63 published case reports over a period of 20 years (2000-2020) have been summarized in a review article on the incidence of this disease. The patients' mean age at diagnosis is five years of age, however, the tumour is also found in very small children as well as in adolescents and in adults.

2.1. Cause: how does pancreatoblastoma develop?

So far, the causes of pancreatoblastoma are still unknown. However, the tumour has been observed more frequently in children with certain *genetic* co-morbidities (such as *Beckwith-Wiedemann syndrome*). This implies that alterations within these *gene*s may also play a role in the development of pancreatoblastoma.

2.2. Symptoms: what are the signs of the disease?

Since the pancreas is sort of hidden in the abdomen, *symptom*s are often unspecific and only appear with rather large tumours. Frequent symptoms are stomach aches and an increase in abdominal circumference or a palpable tumor in the abdomen, respectively. Weight loss and fatigue may also occur while jaundice is rather rare. The stool can be colourless, thereby presenting with a colour that reminds of clay or chalk.

2.3. Diagnosis: what kinds of tests are required?

Usually, the paediatrician will take a thorough history (*anamnesis*) and perform a *physical examination* followed by a routine blood test. This includes a complete *blood count* (CBC) as well as liver function tests and tests of the pancreatic *enzyme*s. As a specific parameter, *alpha-fetoprotein* (AFP) levels are determined, since they can be elevated with these types of tumour. AFP also works as a marker for tumour response to therapy during treatment. Therefore, AFP is called a *tumour marker*.

Imaging of the tumour is also important to obtain information on its location, growth pattern and spread in adjacent or even distant organs and tissues. This is done by using different imaging techniques such as *ultrasound* (sonography), *magnetic resonance tomography* (MRT, layered scanning of the body using magnetic fields and radio waves) or *computed tomography* (CT, detailed x-ray slices of the body).

2.4. Therapy: how is treatment done?

The tumour should be surgically removed completely. If this is impossible because of vital organs and blood vessels being already involved, *chemotherapy* is used to shrink the tumour prior to *surgery*. For this, the agents doxorubicin and cisplatin are used. Treatment is based on the strategy applied to childhood liver tumours (hepatoblastomas), which are biologically similar. Radiation therapie (*radiotherapy*) is done only rarely, in case neither chemotherapy nor surgery appears to be a promising approach.

Important: the tumours behave aggressively and require optimal treatment adapted to the patient's risk of relapse. Hence, please do not hesitate to seek advice.

2.5. Prognosis: what are the chances of cure?

The chances of cure (prognosis) for children and adolescents with pancreatoblastoma are slightly more favourable than for adults with malignant pancreatic tumours. It is assumed that more than half of the patients achieve long-term survival.

A major impact on *prognosis* is whether the tumour has already reached an advanced stage, meaning whether there is spread (metastasis) to the liver, lungs, bones or brain. Usually, the more extended the spread at initial diagnosis, the more unfavourable are the chances of cure.

Particularly important is an optimal treatment planning with the goal to achieve total gross tumour resection. Due to the rarity of these tumours and their complicated anatomical location, surgery should only be performed after discussion in an interdisciplinary tumour board and by experienced surgeons. In addition, patients and families require thorough professional care (by paediatricians and paediatric surgeons) during and after treatment.

3. Solid pseudopapillary tumours (SPT) of the pancreas

Solid pseudopapillary tumours (SPT) are rare tumours of the pancreas. Since 1959, more than 750 new diagnoses have been reported in the literature. Striking is the high incidence in young women. In about 10 % of all patients, children and adolescents are affected.

3.1. Cause: how do SPT develop?

So far, nothing is known about the mechanism of how solid pseudopapillary tumours develop. There are also no known risk factors.

3.2. Symptoms: what are the signs of the disease?

Symptoms can vary a lot. Most patients are completely free of complaints and the tumour is detected during a routine physical exam. Sometimes, however, pain or a palpable tumour in the upper abdomen, back pain, jaundice, nausea and/or vomiting are reported.

3.3. Diagnosis: what kinds of tests are required?

Usually, the paediatrician will take a thorough history (*anamnesis*) and perform a *physical examination* followed by a routine blood test. This includes a complete *blood count* (CBC) as well as liver function tests and tests of the pancreatic *enzyme*s. Different from pancreatoblastoma (*please see above*), no specific lab value has been identified that could be used as a *tumour marker*. However, *alpha-fetoprotein* (AFP) levels should be determined to rule out a malignant pancreatoblastoma.

Imaging of the tumour is also important to obtain information on its location, growth pattern and spread in adjacent or even distant organs and tissues. This is done by using different *imaging* techniques such as *ultrasound* (sonography), *magnetic resonance tomography* (MRT, layered scanning of the body using magnetic fields and radio waves) or *computed tomography* (CT, detailed x-ray slices of the body).

3.4. Therapy: how is treatment done?

Goal of therapy is the total removal (gross total resection) of the tumour tissue. In children and adolescents this can be managed particularly well. If total resection is not an option, the children also benefit from partial removal. Tumour spread (metastasis) is rare and should be removed surgically as well. Chemo- and radiotherapy do not play a role for therapy and are only done in very rare scenarios. Do not hesitate to seek advice in complicated situations.

3.5. Prognosis: what are the chances of cure?

Patients with a solid pseudopapillary tumour usually have a very good *prognosis*. 97 % of the patients are still alive after five years. Within about 10 years after diagnosis, 15 % of the patients develop spread to the liver and peritoneum and, more rarely, also *lymph node* metastases [see *metastasis*]. Therefore, it is important that patients are being cared for by experienced, specially trained paediatricians even after the end of treatment.

4. Other pancreatic tumours in childhood and adolescence

So-called neuroendocrine tumours can arise from the *hormone*-producing cells of the pancreas. In childhood and adolescence, these tumours are found mostly in patients who are suffering from multiple endocrine neoplasia syndrome (*MEN syndrome*); the tumour is then caused by an inherited *mutation* of a cancer gene.

Neuroendocrine tumours can be benign or malignant; the latter are *carcinoma*s, which can partially take an aggressive course and develop *metastasis*. In Germany, children and adolescents with these tumours are registered with the GPOH-MET Registry, which also considers other malignant childhood endocrine tumours. The registry provides advice upon optimal treatment, too.

Aside from these, there are very rare **other childhood carcinomas** of the pancreas, for example the *acinar cell carcinoma* or *adenocarcinoma*. Treatment of these tumours is mostly based on the recommendations for adult patients. As for prognosis, gross total resection is crucial for these tumours as well. Please don’t hesitate to seek advice.

Psychosocial Care

A child's cancer is a stressful situation for the whole family. The psychosocial team of the clinic or later the aftercare facility provides advice and support to patients and their relatives from diagnosis to completion of treatment as well as during aftercare. Don't hesitate to take advantage of this offer. It is an integral part of the treatment concept of all paediatric oncology centres in many countries. Here you will find comprehensive information on this.

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Glossary

acinar cell carcinoma	malignant tumour resulting from certain glandular cells (acinar cells) of the salivary glands; acinar cells are found in the glandular ducts of various organs, especially in the salivary glands of the lower jaw, but also in the pancreas, liver and lungs.
adenocarcinoma	malignant tumour arising from glandular tissue (glandular epithelium); adenocarcinomas can form in various organs, e.g. in the pancreas (pancreatic carcinoma), in the stomach (gastric carcinoma) or in the esophagus (esophageal carcinoma).
anamnesis	medical interview, a patient's history, development of signs of illness; the type, onset and course of the (current) symptoms as well as any risk factors (e.g. hereditary diseases) are evaluated during a medical interview.
Beckwith-Wiedemann syndrome	congenital or acquired clinical condition, characterized in particular by a pathologically increased one-sided growth of the body (hemihypertrophy), enlargement of the liver, spleen or kidneys, considerably enlarged tongue, umbilical (cord) rupture, maldevelopment of the auricles, kidney abnormalities and an increased risk to develop certain malignant diseases (especially Wilms tumours); BWS is one of the cancer predisposition syndromes and is caused by various genetic changes (on chromosome 11).
blood count	blood test to determine the qualitative and quantitative composition of the blood in a blood sample: the number of red and white blood cells as well as platelets, the haemoglobin content (Hb value) of the blood and the volume fraction of red blood cells in the entire blood volume (haematocrit) are assessed. The "complete blood count" also includes a so-called differential blood cell count, in which the white blood cells in particular are examined more precisely for their composition (percentages of the various subtypes) and their appearance.
carcinoma	malignant tumour resulting from degenerated epithelial tissue (e.g. skin, mucous membranes, glandular tissue);
chemotherapy	here: use of drugs (chemotherapeutic agents, cytostatics) for the specific inhibition of tumor cells in the organism
computed tomography	imaging, X-ray diagnostic procedure; it produces an image by computer-controlled evaluation of a large number of X-rays from different directions. This makes it possible to produce sliced

	images of body parts (tomograms, transverse or longitudinal sections of the human body)
embryonal	here: in an early stage of development, immature;
endocrine	"releasing inwards"; endocrine glands release their secretions directly (i.e. without an excretory duct) into the blood. Generally, hormones are secreted via endocrine glands. The terms „endocrine gland“ and „hormone gland“ mean the same.
enzyme	substances, usually proteins, that initiate, accelerate and catalyze biochemical reactions in a desired direction; enzymes are responsible for the metabolism of all organisms. Almost all biochemical processes in the organism are controlled by enzymes (e.g. digestion, protein biosynthesis, cell division). In addition, they also play an important role in stimulus uptake and transmission as well as signal transduction within cells.
exocrine	"releasing to the outside"; exocrine glands release their substances via an excretory duct to external or internal surfaces (e.g. to the skin or to the intestine or genitourinary tract)
gene	unit of genetic information in the genome of living organisms; a gene contains the genetic information – the blueprint – for a specific gene product (protein or RNA). In most organisms, the entirety of all genes, the genome, is present as a deoxyribonucleic acid chain (DNA), which forms the chromosomes in the cell nucleus. The information of a gene is mediated by a certain sequence of the nucleic acid building blocks adenine, guanine, cytosine and thymine.
genetic	concerning the (level of) inheritance or genes; inherited
glucagon	peptide hormone that is primarily responsible for increasing blood sugar levels, acting as the antagonist of insulin. Glucagon is produced in the islets of Langerhans cells in the pancreas.
hormone	chemical signaling substances (proteins) that are produced in different body glands and have different tasks (for example: thyroid hormone, growth hormone, sex hormones).
imaging	diagnostic procedures generating images of the inside of the body, such as ultrasound and X-ray examination, computed tomography, magnetic resonance imaging, and scintigraphy
insulin	hormone that lowers blood sugar (glucose) and influences many different metabolic processes; it is produced in the Langerhans cells of the pancreas.

MEN syndrome	MEN stands for "multiple endocrine neoplasms"; a rare hereditary disorder belonging to cancer predisposition syndromes that promotes the cancerous proliferation of hormone glands, affecting at least two different hormone-producing (endocrine) glands; there are three types of MEN syndrome: MEN 1, MEN 2a and MEN2b. MEN type 1 (also called Wermer syndrome) is characterized by adenomas of the pituitary gland, parathyroid gland, and tumours of the pancreas. In MEN type 2a (Sipple syndrome) and MEN type 2b (Wagemann-Froboese syndrome), tumours often form in the thyroid gland, parathyroid glands and adrenal medulla (phaeochromocytoma). Depending on the type, there are different genetic defects that are inherited in an autosomal dominant manner.
metastasis	1. tumour spread from the primary site of tumour to other parts of the body; characteristic feature of malignant tumours (cancer). 2. collective term for a disease process characterized by malignant cells spreading from their primary site to other areas of the body via the bloodstream and/or the lymphatic system.
mutation	alteration of genetic material; it can arise without any identifiable external cause (so-called spontaneous mutation) or be caused by external influences (induced mutation). External influences include, for example, ionizing radiation or certain chemical substances (mutagens). If somatic cells are affected, it is referred to as a somatic mutation, and if germ cells are affected, it is referred to as a generative mutation. Somatic mutations are not heritable, while germ cell mutations can lead to hereditary damage. Depending on the extent of the change (single or multiple genes, larger chromosome segments or complete chromosomes), a distinction is made between point and block mutations as well as numerical and structural chromosomal aberrations.
physical examination	an important part of diagnostic examinations; includes palpation and listening to certain body organs as well as testing reflexes to obtain indications of the nature or course of a disease.
prognosis	prediction of the course and outcome of a disease / prospect of recovery
radiotherapy	controlled use of ionizing (high-energy) radiation for the treatment of malignant diseases
surgery	surgical intervention on or in the body of a patient for the purpose of treatment, less often also in the context of diagnostics;

	the surgical intervention is carried out with the help of special instruments, generally with the patient under anesthesia.
symptom	sign of illness
tumour marker	biological substance (e.g. protein) in the blood or other body fluids, the increased concentration of which may indicate a newly developed tumour or tumor recurrence; tumor markers play a major role in monitoring the course of the disease in patients who presented with elevated concentrations of a certain tumour marker at the time of cancer diagnosis. Tumour markers are not proof of an existing cancer, because on the one hand, they also occur naturally in the body, and on the other hand they do not necessarily rule out a tumour if they are missing (i.e. not present in conspicuously elevated concentrations).
ultrasound	an imaging technique used to examine organs, in which ultrasound waves are sent through the skin into the body; at tissue and organ boundaries, the sound waves are reflected back, picked up by a receiver (transducer) and converted into corresponding images with the help of a computer.