Pancreatic Tumours in Children: Diagnosis, Treatment and Outcome

Omar Nasher1, Nigel J Hall2, Neil J Sebire3, Paolo de Coppi1, Agostino Pierro4

*1Department of Paediatric Surgery, UCL Institute of Child Health & Great Ormond Street Hospital for Children, London, United Kingdom.*

*2Faculty of Medicine, University of Southampton, Southampton, United Kingdom*

*3Department of Paediatric Histopathology, UCL Institute of Child Health & Great Ormond Street Hospital for Children, London, United Kingdom.*

*4Division of General and Thoracic Surgery, The Hospital for sick Children, Toronto, Canada*

**Corresponding author:**

Prof Agostino Pierro - [agostino.pierro@sickkids.ca](mailto:agostino.pierro@sickkids.ca)

**ABSTRACT**

**Purpose:** Pancreatic tumours in children are exceedingly rare and as a result constitute a diagnostic and therapeutic challenge to paediatric surgeons. We reviewed our experience with these rare entities.

**Methods:** Retrospective single institution study on all paediatric pancreatic tumours over a period of 38 years (1973-2011) and literature review. We recorded data relating to the clinical features at presentation, diagnostic evaluation, treatment and outcome.

**Results:** Fourteen patients were identified (8 male). The most common symptoms at presentation were abdominal pain, anorexia and vomiting. Two cases were discovered incidentally. There were 12 primary and 2 metastatic tumours. Tumour types were Solid Pseudopapillary neoplasm (n=6), Insulinoma (n=3), Pancreatoblastoma (n=1), congenital pancreatic cyst(n=1), Burkitt lymphoma of the pancreas (n=1) and metastatic lesions of other primary tumours(n=2). Twelve were treated with surgical resection including 2 laparoscopically. Post-surgical complications included acute pancreatitis (n=2) and pancreatic pseudocyst (n=2). There was one death from a metastatic tumour and treatment is ongoing in one patient. The remainder have survived.

**Conclusion:** Paediatric pancreatic tumours are rare entities and are usually benign. Clinical symptoms are often non-specific and presentation may be late due to tumour inactivity in case of endocrine neoplasms. For most tumours, surgical resection is the optimal treatment which may be successfully performed laparoscopically when the lesion is in the body or tail of the pancreas. Long term outcome is generally good.

**Key words:** Pancreatic, Paediatric, Neoplasm, Cancer, Surgery

**INTRODUCTION:**

Pancreatic tumours in children present a rare and hence challenging problem for paediatric surgeons who may lack experience in the management of these patients. Only 41 cases of pancreatic tumours were reported to the UK National Registry of Childhood Tumours from 1971 to 2000 and 11 cases were Pancreatoblastomas. According to the UK Registry, the most common pancreatic tumour is Pancreatoblastoma followed by Solid Pseudopapillary tumours and Islet Cell tumours [1].

The aim of this study was to review our institutional experience of pancreatic tumours in children with a particular focus on the presentation, diagnosis, treatment and outcomes.

**METHODS:**

With institutional approval, a retrospective case-note review was undertaken of all pancreatic tumours treated at Great Ormond Street Hospital for Children, London during a period of 38 years (1973 – 2011). Patients with a pancreatic tumour were identified from the histopathology reports of all pancreatic lesions recorded during that period. Data relating to the clinical features at presentation, diagnostic evaluation, treatment and outcome were recorded.

**RESULTS:**

A total of 14 patients were identified (8 males) age range 32 days to 15 years. Full clinical details were available for only 12 patients due to incomplete casenotes. Details of individual patients including clinical features and treatment are shown in Table 1 and Figure 1.

*Diagnosis:*

The presenting clinical features were typically non-specific and comprised abdominal pain, nausea and/or vomiting and anorexia. Tumours with an endocrine component had clinical features related to the biological action of the secretant including hypoglycaemia and hypoglycaemic seizures and Cushingoid features. Initial radiological investigation was typically ultrasound (US) followed by computed tomography (CT). Magnetic resonance imaging (MRI) was used in one case in this series. Pre-excisional tissue biopsy was used in only 2 children under ultrasound (n=1) or CT (n=1) guidance. Eight children had an intra-operative (frozen section) biopsy during excision.

The most common pancreatic tumour in this series was a Solid Pseudopapillary neoplasm (6 cases; Table 1, cases 4,8,9,10,13,14). The clinical presentation was always a constellation of non-specific gastrointestinal symptoms. All patients had US and CT scan and one child had a pre-excisional biopsy. All children had complete surgical excision of the pancreatic mass including one laparoscopically. Pancreas preserving, non-mutilating surgery was performed whenever possible. Two patients developed peri-pancreatic fluid collection following excision, one of which resolved spontaneously and one which matured into a pseudocyst and resolved following a drainage procedure.

There were 3 endocrine neoplasms (Table 1, cases 3,6,7), all insulin-secreting tumours (insulinomas) which presented with symptoms attributable to hypoglycaemia in addition to non-specific gastrointestinal symptoms. The preferred treatment was surgical excision, including one case commenced laparoscopically but subsequently converted to laparotomy to control haemorrhage from the splenic vein. One procedure was complicated by post-operative septic shock and acute haemorrhagic pancreatitis requiring admission to the intensive care unit.

There were 2 metastatic tumours to the pancreas (Table 1, cases 1,11). The first case was a 13 year old girl with a metastatic Nephroblastoma (Wilms’ tumour) to the head of the pancreas. She previously had a right nephrectomy and adrenalectomy at the age of 6 years and represented with abdominal discomfort and jaundice. Biopsy showed same appearance of Nephroblastoma and did not suggest a primary pancreatic tumour. She was treated with chemotherapy. The second case was a Desmoplastic Small Round Cell Tumour of Childhood arising from the retroperitoneum and infiltrating the pancreas and stomach in a 12 year old boy. He was treated with surgery, chemotherapy and radiotherapy but unfortunately died one year later.

The final 3 cases occurred just once each in this series and included a 9 year old boy (Table 1, case 2) with a Pancreatoblastoma who presented with abdominal pain and Cushingoid features. He had raised adrenocorticotrophic hormone (ACTH, 700 ng/L) that accounts for the clinical presentation as well as a raised α-fetoprotein (97,582 ng/mL). Following surgical excision he developed a pseudocyst. He also received adjuvant chemotherapy and following one course of chemotherapy developed febrile neutropenia and acute renal failure requiring peritoneal dialysis for five days. The other tumours were a Burkitts lymphoma (Table 1, case 5) which was treated with chemotherapy alone following percutaneous ultrasound guided biopsy and a congenital pancreatic cyst which was excised (Table 1, case 12).

*TABLE 1*

*FIGURE 1*

**DISCUSSION:**

In the adult population, pancreatic tumours represent almost 3% of all malignancies and are predominantly ductal in origin [2]. In contrast, pancreatic tumours in the paediatric population are much rarer, have a different histopathological basis [3] and are generally benign although some lesions may have malignant potential [4]. In our series, the majority of lesions were benign although malignant tumours were encountered including 2 cases of secondary invasion of the pancreas by primary tumours originating elsewhere.

The most common tumour in our series was a Solid Pseudopapillary neoplasm of the pancreas. In similarity to previous reports [5, 6], most cases were in females and in the tail of the pancreas. This tumour frequently presents with non-specific symptoms including abdominal pain and vomiting and it is not unusual for these tumours to be detected incidentally on ultrasound scan following trauma or for an unrelated reason. This mode of presentation has been attributed to the slow growth of this tumour [7]. Pancreatic and liver enzymes as well as tumour markers are usually within normal limits [7]. In some cases, patients can present with anaemia and haemoperitoneum [7]. Treatment of Solid Pseudopapillary neoplasm of pancreas is typically complete surgical excision [7]. However, complete regression without the need for surgical intervention has been reported [8].

Endocrine pancreatic tumours are mainly solitary lesions and 90% are benign. The majority of these types of tumours occur in children older than 4 years although neonatal cases have been documented [9]. Their clinical features are determined predominantly by the specific hormone (e.g. insulin, glucagon, gastrin or somatostatin) which is oversecreted by the tumour. The most frequent endocrine tumour in this series was the insulinoma (beta-cell tumour) including one patient whose clinical features included hypoglycaemia with seizures. Other symptoms are typically nonspecific.

Although other endocrine tumours were not observed in the current series, glucagon, gastrin and somatostatin secreting pancreatic tumours have all been reported in the paediatric age group [9]. Some manifestations of glucagon-secreting tumours (glucagonomas arising from the alpha-cells) include diabetes mellitus, venous thrombosis, cheilitis, stomatitis, diarrhoea and skin rash (Necrolytic Migratory Erythema) which typically involve groin, intergluteal, and genital areas [10].

Gastrinomas (gamma-cell tumours) cause hypersecretion of gastric acid and hence a predisposition to peptic ulcer disease. Gastrinomas can also be part of Multiple Endocrine Neoplasia type 1 (approximately 25% of cases) involving more than one anatomical site and they also represent the source of gastrin in Zollinger-Ellison (Z-E) syndrome. Forty-four cases of Z-E are recorded in the Childhood Disease Registry among which thirty-eight cases occurred in boys [9]. Somatostatinomas (delta-cell tumours) and VIPomas are extremely rare in children. In contrast with adults, VIP-producing tumours are more frequently associated with non-pancreatic tumours (e.g. Neuroblastoma) [9].

Despite the high prevalence of Pancreatoblastomas reported to the UK National Registry of Childhood tumours from 1971 to 2000, in our series we only had one case of this type of malignancy in a child presenting with a large abdominal mass. Pancreatoblastoma shares similar histologic and morphologic features with Hepatoblastoma including secretion of α-fetoprotein [11]. In addition, it appears to affect a similar age group and it is generally responsive to the same chemotherapeutic agents (high risk Hepatoblastoma protocol) with a satisfactory clinical response [11]. Pancreatoblastoma can be associated with Beckwith-Wiedemann syndrome [12].

The remaining cases in our series were both extremely rare yet successfully treated. Burkitt lymphoma accounts for less than 1% of lymphoma involving the pancreas, but may resemble pancreatic adenocarcinoma so it is vital to differentiate the two [13]. Chemotherapy is typically more effective for pancreatic lymphoma than it is on pancreatic adenocarcinoma [14].

One child had a pancreatic cyst which was felt to be congenital based on pathological appearance and was treated with uncomplicated open surgical excision and abolition of symptoms. True congenital pancreatic cysts are extremely rare in children and in fact, less than 1% of true pancreatic cysts occur in the paediatric population [15]. Treatment options include surgical excision, aspiration (not recommended) and drainage with cyst marsupialization [16].

In this series, we used transabdominal ultrasound followed by computed tomography as the initial modes of imaging. Magnetic resonance imaging does not appear to have higher sensitivity than CT scan although magnetic resonance cholangiopancreatography (MRCP) may be useful to delineate anatomy when ductal obstruction is present.

The majority of children with pancreatic tumours present with isolated lesions and are good surgical candidates. In cases of obstructive jaundice, endoscopic retrograde cholangiopancreatography (ERCP) with stent placement can be used to relieve biliary tract obstruction [17]. Primary surgical excision without need for definitive preoperative tissue diagnosis is recommended [18]. A laparoscopic approach to paediatric pancreatic tumours has been previously reported and was also adopted in our series [19]. Laparoscopic central pancreatectomy with distal pancreaticogastrostomy has been shown to be safe for tumours affecting the body of the pancreas [20]. For lesions located in the pancreatic tail, laparoscopic distal pancreatectomy with preservation of the spleen seems the preferred surgical approach over open surgery [20]. For lesions in the pancreatic head, Witzigmann et al (2007) showed that adults treated with duodenal preserving pancreatic head resection (Beger procedure) as opposed to the standard pancreatoduodenectomy (Whipple procedure), had better pain relief, nutritional status and a shorter length of hospital stay [21].

For children who present with less typical lesions, tissue biopsy (percutaneous or laparoscopic) may be necessary to guide treatment. Metastatic lesions affecting the pancreas are extremely rare. Treatment (including surgery, chemotherapy and radiotherapy) is determined by the type of primary tumour [22].

*TABLE 2*

**CONCLUSION:**

Pancreatic tumours in children are rare entities and generally benign although they may have malignant potential. In the absence of a biologically active tumour, presentation is typically with non-specific symptoms or as an incidental finding. For isolated tumours in the body or tail of the pancreas, primary laparoscopic excision appears to be the optimal treatment resulting in cure in the majority of cases.

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**TABLE 1**: Presentation, location and treatment of pancreatic tumours.

**TABLE 2**: Frequency of pancreatic tumours according to The Surveillance, Epidemiology, and End Results registry (1973-2004).

**FIGURE 1**: Distribution of pancreatic tumours treated at Great Ormond Street Hospital for Children between 1973 and 2011 (n=14).