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Endoscopic retrograde cholangiopancreatography (ERCP) in children with pancreatic diseases

Endoskopowa cholangiopankreatografia wsteczna (ECPW) u dzieci z chorobami trzustki

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S u m m a r y

Endoscopic retrograde cholangiopancreatography (ERCP) is nowadays a valuable method for detailed diagnostic evaluation and minimally invasive therapy for biliary and pancreatic diseases in pediatric population. The technique of ERCP is no more difficult in children than in adults, and except infants, there is no need for use a special pediatric endoscope. In children ERCP is usually performed with the patient under general anesthesia. Routine antibiotic prophylaxis is controversial, because there is no pediatric data regarding this problem. Pediatric indications for ERCP are similar to those for adults, though with a much lower incidence of malignant diseases. Among children with pancreatic diseases a common indications are: acute or recurrent acute pancreatitis, chronic pancreatitis, abdominal pain suspected to be of pancreaticobiliary origin, suspicion of pancreatic ductal anomaly, pancreatic trauma, differential diagnosis of focal pancreatic lesions and preoperative evaluation. Therapeutic ERCP constitutes 30-78% of all ERCPs and has a significant impact on the management of patients with pancreatic diseases, offering an alternative to surgical treatment in some cases. Pediatric studies demonstrates that ERCP has a high degree of technical success and a low rate of complications when performed by experienced endoscopists. MRCP nowadays has become the first-line diagnostic tool for biliopancreatic diseases and in the future ERCP may play a role mainly as a therapeutic intervention.

S t r e s z c z e n i e

Endoskopowa cholangiopankreatografia wsteczna (ECPW) jest wartościową metodą diagnostyczno-terapeutyczną w chorobach dróg żółciowych oraz trzustkowych w populacji pediatrycznej. Technika wykonywania ECPW nie jest trudniejsza u dzieci niż u dorosłych i z wyjątkiem niemowląt nie ma potrzeby stosowania specjalnego endoskopu pediatrycznego. U dzieci zabiegi ECPW są najczęściej przeprowadzane w znieczuleniu ogólnym. Rutynowa profilaktyka antybiotykowa budzi wiele kontrowersji, ponieważ brak jest dostępnych danych pediatrycznych dotyczących tego zagadnienia. Wskazania do wykonywania ECPW u dzieci są podobne jak u pacjentów dorosłych, chociaż ze znacznie mniejszą częstością występowania nowotworów. Wśród dzieci z chorobami trzustki do najczęstszych wskazań do wykonania ECPW należą: ostre lub nawracające ostre zapalenie trzustki, przewlekłe zapalenie trzustki, ból brzucha mogący mieć podłoże w schorzeniu trzustki czy dróg żółciowych, podejrzenie anomalii przewodu trzustkowego, uraz trzustki, diagnostyka różnicowa zmian ogniskowych trzustki oraz ocena przedoperacyjna trzustki. Procedury terapeutyczne stanowią 30-78% wszystkich zabiegów ECPW i odgrywają dużą rolę w leczeniu pacjentów z chorobami trzustki, w niektórych przypadkach oferując alternatywę dla leczenia chirurgicznego. Badania przeprowadzone wśród dzieci pokazują, iż ECPW ma wysoki stopień skuteczności i niski wskaźnik powikłań, gdy wykonywane jest przez doświadczonych endoskopistów. Rezonans magnetyczny dróg żółciowych (MRCP) w dzisiejszych czasach stał się narzędziem diagnostycznym pierwszego wyboru w diagnostyce chorób trzustki i dróg żółciowych. Można się spodziewać, iż w przyszłości zabiegi ECPW będą przeprowadzane przede wszystkim jako interwencja terapeutyczna.

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INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is a complex procedure that has been extensively used in the evaluation and treatment of pancreaticobiliary disorders among adults since the late sixties of the last century. In 1976, Wayne performed the first successful cannulation of the ampulla of Vater in a 3.5-month old infant using the duodenoscope intended for adult patients (1). Initially pursuance of ERCP was limited to older children. Since the development in the technique and construction of a pediatric duodenoscope in 1991, the frequency of its use in younger patients, infants and newborns has increased. At present ERCP has become an established method for detailed diagnostic evaluation and minimally invasive therapy for biliary and pancreatic diseases in the pediatric population.

This article will review the current state of knowledge about ERCP in pediatric patients with pancreatic disorders, concentrating on the equipment, technique, indications, contraindications and the complications.

TECHNIQUE AND EQUIPMENT

Conventional "adult" duodenoscopes can be safely used in the most pediatric patients more than 1 year of age or weighing more than 10 kg (2-7). For smaller infants and neonates, a pediatric duodenoscope with an outer diameter of 7.5 mm is available. This instrument has a 2.0-mm operative channel, delimiting the range of accessories that can be used. However sphincterotomes, extraction baskets, and retrieval balloons are commercially accessible, in the most of medical centers standard duodenoscopes are employed for therapeutic interventions. The 2.0-mm working channel enables appliance up to a 5-Fr stent (8). The procedures are performed under fluoroscopy control with an exposure of radiation kept to the minimum.

In small children and neonates there is a significantly greater airflow resistance and increased risk of dynamic or static episodes of airway occlusion than in adults. Furthermore, the semiprone position used for ERCP can be conducive to hypoventilation. With regard to these factors, the longer duration and degree of difficulty of many pediatric ERCPs, as well as the poor children cooperation during the procedure, they are most commonly performed under general anesthesia (3, 4, 7, 9). Among older children often conscious sedation is equally well used (6, 10, 11).

The important factor appears to be the experience of the endoscopist with ERCP. There are no established criteria of minimum number of interventions that must be performed before gaining competence in this age-group, but in conformity to the results of different studies and guidelines of the major gastrointestinal and surgical endoscopy societies (ASGE, SAGES, AGA) a minimum threshold of 50-100 ERCPs is usually mentioned (5, 12).

Routine antibiotic prophylaxis is controversial, because there is no pediatric data regarding this problem. In adults antibiotic prophylaxis is recommended before an ERCP in patients with communicating pancreatic cysts or pseu-

docysts and before transpapillary or transmural drainage of pseudocysts (13). Further investigation and analysis is needed to answer this challenging question.

CONTRAINDICATIONS

Considered altogether, the contraindications for ERCP are the same as for upper endoscopy and include such as unstable pulmonary, cardiovascular or neurologic condition and suspected bowel perforation (2, 14, 15). Prior hepatopertoenterostomy (Kasai procedure) and anomaly or obstruction of oesophagus or stomach, which unable access to the duodenum, makes ERCP almost impossible (14). Coagulation disorders are a relative contraindication and should be corrected before ERCP. Insufficient experience in performing ERCP among pediatric patients should be also take into account.

INDICATIONS

Pediatric indications for ERCP are similar to those for adults, though with a much lower incidence of malignant diseases (15). It has been widely used to evaluate and treat pancreaticobiliary disorders.

In 1994, Werlin reviewed the 6 largest pediatric studies with a total of 260 ERCPs and noted that pancreatic disease was twice as common as biliary tract disease in children (16).

Nowadays, however, it seems that such indications may be changing. Basing on the survey presented by Gilger in 19 published series in children between 1979 and 2002 with a total of 695 procedures performed, biliary indications account for 47%, pancreatic indications for 40%, pain for 12% and other causes for 1 to 3% (17). Also in successive investigations percentage of pancreatic indications occurs to be the minority and varies between 16-45% (10, 11, 14, 18). These results indicates a recent tendency toward increasing share of biliary indications for ERCP in children. Reasons for this change may be inter alia an exposure of MRCP's role in detecting diseases of pancreatobiliary tract and becoming ERCP mainly therapeutic procedure performed for such purposes as extracting biliary stones, which are more and more frequently found in children population (19).

Among children with pancreatic diseases a common indications are: acute or recurrent acute pancreatitis, chronic pancreatitis (CP), abdominal pain suspected to be of pancreaticobiliary origin, preoperative evaluation. ERCP is also attempted when there is a suspicion of pancreatic or pancreatic ductal anomaly, pancreatic trauma or in differential diagnosis of focal pancreatic lesions (tab. 1).

Table 1. Indications for ERCP.

Indications for ERCP
Chronic pancreatitis (CP)
Recurrent acute pancreatitis (RAP)
Acute pancreatitis (AP)
Abdominal pain suspected to be of pancreaticobiliary origin
Suspicion of pancreatic or pancreatic ductal anomaly
Suspicion of pancreatic trauma
Preoperative evaluation
Mass in the pancreas

ACUTE, RECURRENT AND CHRONIC PANCREATITIS

ERCP is valuable in the evaluation and management of chronic pancreatitis. Direct pancreatography provides thorough information about anatomic changes in the main pancreatic duct or it often may be required to confirm definitive diagnosis. Ideally, ERCP should be used for treatment of abnormalities defined by non-invasive imaging techniques. MRCP enable pancreatic and biliary anatomy to be found less invasively, without risk of pancreatitis and radiation exposure. Related to adult studies, ERCP is effective in treating symptomatic strictures in CP (15). Dilation and stenting of pancreatic duct strictures appears to be successful and safe also in children (4, 7, 18), however long-term outcomes remains unknown. One of the most common indications for therapeutic ERCP in children with CP is the presence of calculi within a dilated pancreatic duct. Case series among adults have shown varies results (54-100%) with regard to relief in pain after pancreatic endotherapy (15). Unfortunately pediatric data is limited to a small group of patients (20-22). In some patients pancreatic sphincterotomy and stone removal can be difficult because of underlying duct stricture and may require extracorporeal shock wave lithotripsy (ESWL) to fragment the stones before endoscopic removal (fig. 1) (6).



Fig. 1. ERCP – picture of the chronic pancreatitis. Endotherapy, Warsaw.

In case of acute pancreatitis ERCP is indicated only if therapeutic procedure may resolve the acute episode, such as in gallstone pancreatitis. According to the studies among adult patients, early ERCP (within 24-48 hours of occurrence of symptoms) is advisable in acute biliary pancreatitis when a stone is localized in the common bile duct or when biliary obstruction or cholangitis is noticeable (14). Similar data about ERCP usage in AP in children population are very limited. Rocca et al. (3) described a small group (5 patients) of children with common bile duct stones initially presented with severe acute pancreatitis. After endoscopic sphincterotomy and stone extraction an immediate clinical improvement with complete symptomatic remission was observed.

Acute pancreatitis can lead to recurrent acute pancreatitis if the underlying factor remains uncorrected. On the faith of review of published experience analyzed by Benifla et al. recurrence is reported in 9% patients with an acute pancreatitis episode, most of them with idiopathic and structural etiologies (23). Biliary stones, family history of pancreatitis, drug ingestion, hypercalcemia, hypertriglyceridemia, pancreas divisum and genetic mutations occurs as an etiological factor in patients with RAP (24).

PANCREATIC ANOMALY

Pancreas divisum (PD) is the most common congenital anomaly of pancreatic ductal development, with a reported prevalence of 2.7-22% in general population (25). It arise as a result of failed fusion of the dorsal and ventral pancreatic buds during the 7-th week of intrauterine life. In consequence the major part of pancreas is drained through duct of Santorini. Although most patients with this ductal anomaly remain asymptomatic, a small proportion of them become symptomatic for the most part with RAP (6, 10, 12, 17, 18). Its role in the pathology of CP or chronic abdominal pain (recurrent pancreatic-type) without biochemical or radiographic evidence of pancreatitis remains controversial. The best option for the diagnosis of pancreas divisum currently is ERCP. The aim of the therapeutic intervention in PD is to improve pancreatic drainage through the minor papilla by relieving the obstruction. In the adult patient, endoscopic sphincterotomy of the minor papilla leads to clinical improvement in up to 75% of patients, comparable with the outcome after surgical sphincteroplasty (12). Clinical improvement has been reported after endoscopic therapy in children, but the data are limited to a small subset of patients (10, 17, 18). Anomalous union of the pancreatobiliary ductal system, annular pancreas and dorsal pancreatic agenesis have also been described as a factor of recurrent pancreatitis in children and may be demonstrated by endoscopic pancreatography (19, 26).

PANCREATIC TRAUMA

Blunt pancreatic injuries usually arise as a consequence of compression of the pancreas against the vertebral column. This can lead to glandular breakage, with or without ductal disruption. Nowadays computed tomography (CT) the is most often imaging modality of choice in identifying pancreatic injury, however ERCP also provides a valuable role in assessing integrity of the pancreas after abdominal trauma (9, 11, 27). Disruption of the pancreatic duct (PD) may be detected early and managed endoscopically by placement of a transpapillary stent or surgically (18). The benefits of therapeutic ERCP in children with PD injury are vague, although its application in adults with pancreatic duct leaks from various etiologies has been reported (14). In a small series 2 children with ductal leakage after abdominal trauma, Vegting et al. described their experience with early pancreatic duct stent placement (9).

The stents were removed within 6 weeks of placement. When pancreatic trauma is suspected, ERCP may be useful in planning operative or nonoperative treatment. Poddar et al. described 3 children who underwent successful ERCP with placement of nasocystic drainage of peripancreatic fluid collections with avoidance of invasive surgery (11). Whereas the other study has shown a low success rate of ERCP in management of pancreatic duct disruption in comparison with the adult series, however reasons for duct leakage was not only abdominal injury (7). With regard the uncommon occurrence of pancreatic trauma in children even at large tertiary referral centers, answer to the question about role of ERCP in pediatric injury of pancreas probably will remain unclear.

PSEUDOCYSTS

Pancreatic pseudocyst is a well-documented complication of both blunt pancreatic trauma and acute pancreatitis (28). Pseudocysts may cause pain and compressive symptoms that result in nausea, vomiting, and early satiety, less likely in biliary obstruction. Persistent, symptomatic pseudocysts can be treated by percutaneous drainage, ERCP, ultrasound-guided endoscopic drainage or surgical methods. The adult literature emphasizes the successful introduction of endoscopic transpapillary drainage in treating pancreatic pseudocysts (29, 30), but in pediatric populations most of the studies has been reported in the form of case reports and with no long-term follow up (9, 30, 31). A recent research by Otto et al. presented a series of 10 pediatric patients with pancreatic pseudocyst, but it did not demonstrate a high success rate for ERCP in the management of pseudocysts. Seven patients (70%) needed further surgical treatment (32). However, at present other method of endoscopic therapy – ultrasound-guided endoscopic drainage, receives more and more recognition in management of pancreatic pseudocysts and it seems also to be safe and effective among children (33).

ABDOMINAL PAIN

The utility of ERCP in the evaluation of abdominal pain suspected to be of pancreatobiliary origin in pediatric patients remains questionable. Dua et al. (34) reported a group of 185 children who underwent ERCP because of pain suggestive of a pancreatobiliary disease, with or without objective diagnostic abnormalities (biochemistry or imaging). In those children with preprocedure abnormal findings, ERCP identified a source for abdominal pain in the majority (72%). More than half of them underwent endoscopic intervention with pain resolution. A result of ERCP usefulness also in over 50% of those with abdominal pain alone is noteworthy. 47% of them became pain free from the endoscopic intervention performed. Similarly, Cheng et al. assessed a yield of 41 children with chronic or recurrent abdominal pain, and more than 80% of these children had abnormal ERCP findings. Most of them

had sphincter of Oddi (SOD) dysfunction, which can be successfully treated by sphincterotomy (7). SOD dysfunction has been recognized when a basal pressure was greater than 40 mmHg (35).

On the contrary, other studies showed a poor diagnostic results of only 0 to 22%, in the pediatric population, when using ERCP as a tool to evaluate pain in the absence of other objective abnormalities (11, 36).

ERCP AS THERAPEUTIC INTERVENTION

Therapeutic ERCP has a significant impact on the management of patients with pancreatic diseases, offering an alternative to surgical treatment in some cases. A variety of therapeutic interventions have been reported including sphincterotomy, balloon dilation of the papilla, stone extraction, stent insertion, as well as endoscopic nasal drainage (2, 6, 11, 12). In pediatric series, procedures made for therapeutic purposes constitutes 30 to 78% of all ERCPs (2, 4, 6, 9, 11, 12). In conjunction with the development of MRCP as the diagnostic tool in pancreatic diseases, further increase of this percentage may be expected (fig. 2).

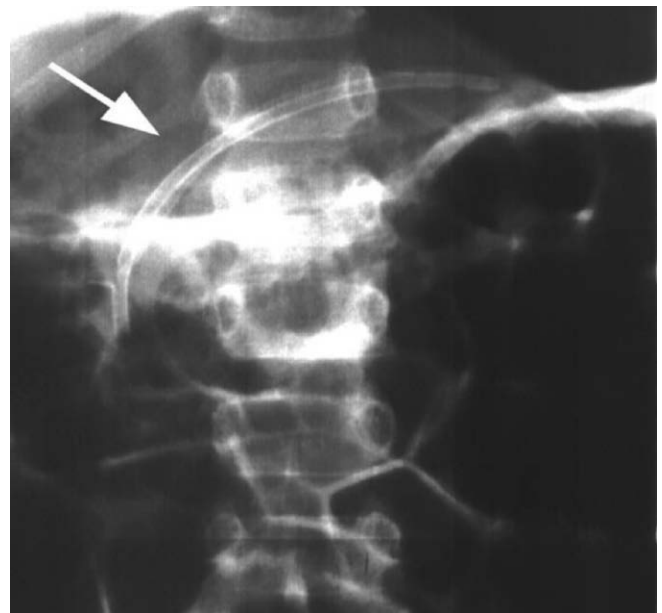


Fig. 2. Pancreatic duct stenting. Endotherapy, Warsaw.

TECHNICAL SUCCESS

ERCP may appear to be technically difficult and challenging in children because of their small anatomy and the need to use scaled-down instruments and devices. However most of the studies clearly demonstrates that ERCP has a high degree of technical success when performed by experienced endoscopists. The success rate of the procedure, defined usually as obtaining adequate imaging of the pancreatobiliary ducts or accomplishing endoscopic therapy amounts 97-100% (2-4, 9, 10, 12, 34) and this results are comparable with adults (4). Only in research by Vegting et al. goal of the ERCP was not achieved in 29% of children, but a relatively large group of all patients (51%) constituted infants (9).

COMPLICATIONS

ERCP-related complications include those of standard endoscopy (hemorrhage, perforation, infection etc.) as well acute pancreatitis and cholangitis. Reported adverse events rates range from 0 to 11% with pancreatitis being the most common complication, as in the adult population (2-4, 6, 9-12, 15, 17-19, 34, 37). Also a study comparing complications of diagnostic and therapeutic ERCP between 116 children and 116 matched adult patients sustained that the complication rate is not significantly different (3.4 vs 2.5%) (4). Post-ERCP pancreatitis (PEP) occurs in up to 9.7% of cases, but it fortunately usually has mild or moderate course (4, 10, 12, 18, 19). According to the consensus criteria it is defined as a new or worsened abdominal pain for more than 24 hours after endoscopy with an amylase level of more than 3 times the upper limit of normal, which either required hospitalization or prolongation of planned hospitalization for more than 2 days (37). Therapeutic procedures and the presence of CP are predictors for the development of PEP (19). Serious bleeding and perforation have rarely been reported after ERCP in children (3, 4, 12). According

to the American Society for Gastrointestinal Endoscopy (ASGE) guidelines, in adult series hemorrhage is reported in 1.2-1.5% of procedures and perforation in 0.3 to 0.6% (13). The rate of ERCP-related bacteremia in children is not well established, but in adult patients it is less than 1% (13).

CONCLUSIONS

The pediatric series published to date already stated that ERCP is a valuable diagnostic and therapeutic tool in carefully selected children with known or suspected biliary or pancreatic disease, when performed by experienced endoscopists. However a clear consensus for appropriate indications and choice of endoscopists treatment has not been achieved yet. New radiologic techniques such as MRCP will continue to advance and likely replace many previous diagnostic uses of ERCP. As a result, ERCP in the future may play a role mainly for therapeutic purposes, such as pancreatic or biliary duct stone removal or new endoscopic treatments of chronic pancreatitis.

BIBLIOGRAPHY

- Waye JD: Endoscopic retrograde cholangiopancreatography in the infant. *Am J Gastroenterol* 1976; 65: 461-463.
- Hsu RK, Draganov P, Leung JW et al.: Therapeutic ERCP in the management of pancreatitis in children. *Gastrointest Endosc* 2000; 51: 396-400.
- Rocca R, Castellino F, Daperno M et al.: Therapeutic ERCP in pediatric patients. *Digestive and Liver Disease* 2005; 37: 357-362.
- Varadarajulu S, Wilcox CM, Hawes RH et al.: Technical outcomes and complications of ERCP in children. *Gastrointest Endosc* 2004; 60: 367-371.
- Green JA, Scheeres DE, Conrad HA et al.: Pediatric ERCP in a multidisciplinary community setting: experience with a fellowship trained general surgeon. *Surg Endosc* 2007; 21(12): 187-192.
- Agarwal J, Nageshwar Reddy D, Talukdar R et al.: ERCP in the management of pancreatic diseases in children. *Gastrointestinal Endoscopy* 2013 Sep 20. E-pub ahead of print.
- Cheng CL, Fogel EL, Sherman S et al.: Diagnostic and therapeutic endoscopic retrograde cholangiopancreatography in children: a large series report. *J Pediatr Gastroenterol Nutr* 2005; 41: 445-453.
- Kato S, Kamagata S, Asakura T et al.: A Newly Developed Small-Caliber Videoduodenoscope for Endoscopic Retrograde Cholangiopancreatography in Children. *J Clin Gastroenterol* 2003 Aug; 37(2): 173-176.
- Vegting IL, Tabbers MM, Taminiu JA et al.: Is endoscopic retrograde cholangiopancreatography valuable and safe in children of all ages? *J Pediatr Gastroenterol Nutr* 2009; 48: 66-71.
- Paris C, Bejjani J, Beaunoyer M et al.: Endoscopic retrograde cholangiopancreatography is useful and safe in children. *Journal of Pediatric Surgery* 2010; 45: 938-942.
- Poddar U, Thapa BR, Bhasin DK et al.: Endoscopic retrograde cholangiopancreatography in the management of pancreaticobiliary disorders in children. *J Gastroenterol Hepatol* 2001; 16: 927-931.
- Jang JY, Yoon CH, Kim KM et al.: Endoscopic retrograde cholangiopancreatography in pancreatic and biliary tract disease in Korean children. *World J Gastroenterol* 2010; 16: 490-495.
- Anderson MA, Fisher L, Jain R: Complications of ERCP. *ASGE STANDARDS OF PRACTICE COMMITTEE. Gastrointestinal Endoscopy* 2012; 75(3): 467-473.
- Adler DG, Baron TH, Davila RE et al.: ASGE guideline: the role of ERCP in diseases of the biliary tract and the pancreas. *STANDARDS OF PRACTICE COMMITTEE. Gastrointestinal Endoscopy* 2005; 62(1): 1-8.
- Fox VL, Werlin SL, Heyman MB et al.: Endoscopic retrograde cholangiopancreatography in children. Subcommittee on endoscopy and procedures of the patient care committee of the North American Society for Pediatric Gastroenterology and Nutrition. *J Pediatr Gastroenterol Nutr* 2000; 30: 335-342.
- Werlin SL: Endoscopic retrograde cholangiopancreatography in children. *Gastrointest Endosc Clin N Amer* 1994; 4: 161-178.
- Gilger MA: ERCP in Children. *Techniques in Gastrointestinal Endoscopy* 2002; 4: 207-212.
- Lin TK, Barth BA: Endoscopic retrograde cholangiopancreatography in pediatrics. *Techniques in Gastrointestinal Endoscopy* 2013; 15: 41-46.
- Iqbal CW, Baron TH, Moir CR et al.: Post-ERCP pancreatitis in pediatric patients. *J Pediatr Gastroenterol Nutr* 2009; 49: 430-434.
- Guelrud M, Mujica C, Jaen D et al.: The role of ERCP in the diagnosis and treatment of idiopathic recurrent pancreatitis in children and adolescents. *Gastrointest Endosc* 1994; 40: 428-436.
- Kozarek R, Christie D, Barklay G et al.: Endoscopic therapy of pancreatitis in the pediatric population. *Gastrointest Endosc* 1993; 39: 665-669.
- Pieczarkowski S, Pertkiewicz J, Fyderek K: Czy ECPW u dzieci jest potrzebne? *Pediatrica Współczesna Gastroenterologia, Hepatologia i Żywnienie Dziecka* 2010; 4: 175-178.
- Benifla M, Weizman Z: Acute pancreatitis in childhood: analysis of literature data. *Journal of Clinical Gastroenterology* 2003; 37(2): 169-172.
- Sánchez-Ramírez CA, Larrosa-Haro A, Flores-Martínez S et al.: Acute and recurrent pancreatitis in children: etiological factors. *Acta Paediatr* 2007; 96(4): 534-537.
- Rustagi T, Golioto M: Diagnosis and therapy of pancreas divisum by ERCP: A single center experience. *Journal of Digestive Diseases* 2013; 14: 93-99.
- Mori K, Nagakawa T, Ohta T et al.: Pancreatitis and anomalous union of the pancreaticobiliary ductal system in childhood. *J Pediatr Surg* 1993; 28: 67-71.
- Rescorla FJ, Plumley DA, Sherman S et al.: The efficacy of early ERCP in pediatric pancreatic trauma. *J Pediatr Surg* 1995; 30: 336-340.
- Haluszka O, Campbell A, Horvath K et al.: Endoscopic management of pancreatic pseudocyst in children. *Gastrointest Endosc* 2002 Jan; 55(1): 128-131.
- Cohen S, Bacon BR, Berlin JA, Fleischer D: National Institutes of Health State-of-the-Science Conference Statement: ERCP for diagnosis and therapy, January 14-16, 2002. *Gastrointest Endosc* 2002; 56: 803-809.
- Breckon V, Thomson SR, Hadley GP et al.: Internal drainage of pancreatic pseudocysts in children using an endoscopically-placed stent. *Pediatr Surg Int* 2001 Nov; 17(8): 621-623.
- Oracz G, Pertkiewicz J, Oralewska B et al.: Pseudotorbiele trzustki u dzieci z przewlekłym zapaleniem trzustki. *Pediatrica Współczesna. Gastroenterologia, Hepatologia i Żywnienie Dziecka* 2010; 12: 172-174.
- Otto AK, Neal MD, Slivka AN et al.: An appraisal of endoscopic retrograde cholangiopancreatography (ERCP) for pancreaticobiliary disease in children: our institutional experience in 231 cases. *Surg Endosc* 2011; 25: 2536-2540.

33. Sharma SS, Maharshi S: Endoscopic management of pancreatic pseudocyst in children: a long-term follow-up. *J Pediatr Surg* 2008; 43: 1636-1639.
34. Dua K, Miranda A, Santharam R et al.: ERCP in the evaluation of abdominal pain in children. *Gastrointest Endosc* 2008 Dec; 68(6): 1081-1085.
35. Misra S, Treanor MR, Vegunta RK et al.: Sphincter of Oddi dysfunction in children with recurrent abdominal pain: 5-year follow-up after endoscopic sphincterotomy. *J Gastroenterol Hepatol* 2007; 22: 2246-2250.
36. Buckley A, Connon JJ: The role of ERCP in children and adolescents. *Gastrointest Endosc* 1990 Jul-Aug; 36(4): 369-372.
37. Cotton PB, Eisen GM, Aabakken L et al.: A lexicon for endoscopic adverse events: report of an ASGE workshop. *Gastrointest Endosc* 2010; 71: 446-454.
38. Barth BA, Banerjee S, Bhat YM et al.: Equipment for pediatric endoscopy. *Gastrointest Endosc* 2012; 76: 8-17.
39. Ryzko J, Górczewska M, Jankowska I et al.: Patogeneza kamicy żółciowej. *Pediatrica Współczesna Gastroenterologia, Hepatologia i Żywnie Dziecka* 2011; 1: 50-54.

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