ORIGINAL ARTICLE

DIAGNOSTIC AND THERAPEUTIC VALUE OF ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY (ERCP) IN PAEDIATRIC PATIENTS: A SEVEN-YEAR EXPERIENCE AT A TERTIARY CARE HOSPITAL

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Background: Endoscopic retrograde cholangiopancreatography (ERCP) is an established modality for the management of pancreaticobiliary disorders in adults, but data on its use in paediatric patients, particularly from low- and middle-income countries, remain limited. This study aimed to evaluate the indications, diagnostic and therapeutic outcomes, and safety of ERCP in children aged 8–17 years at a tertiary care hospital in Pakistan. **Methods:** A retrospective single-centre review of all paediatric ERCPs performed at a tertiary-level private hospital between February 2013 and August 2019 was conducted. Children aged 17 years or younger who underwent ERCP during this period were identified from the endoscopy software database; the youngest enrolled patient was 8 years of age. Demographic, clinical, procedural, and outcome variables were extracted onto a structured proforma and analysed using SPSS version 21. Descriptive statistics were applied; continuous variables were reported as mean±standard deviation and categorical variables as frequencies and percentages. **Results:** Forty-five patients aged 8–17 years (mean 15.11±2.42±2.42 years) were enrolled. Of these, 30 (66.7%) were male, and 15 (33.3%) were female. The most common indications were cholestatic liver function tests, followed by pancreatic and common bile duct stones. All procedures were performed under monitored anaesthesia care using midazolam, nalbuphine and propofol; a qualified anaesthetist observed patients throughout and during recovery. Cannulation was successful in 44 of 45 patients (97.8%), and the intended therapeutic procedures, including sphincterotomy and stent placement, were achieved in all cannulated patients. No patient developed post-ERCP pancreatitis, clinically significant bleeding, perforation, cholangitis, or any cardiopulmonary event. Two minor non-procedural adverse events were observed: a skin rash attributed to the pre-procedure antibiotic and self-limiting epistaxis. **Conclusion:** In this retrospective single-centre study, ERCP performed by experienced adult gastroenterologists using an adult duodenoscope under monitored anaesthesia care appeared to be a safe and effective option for selected children aged 8–17 years with pancreaticobiliary disorders. As the cohort consisted predominantly of adolescents and the study was retrospective with a relatively small sample, larger prospective multicentre studies including younger children are required before these findings can be generalised.

Keywords: Cholangiopancreatography, endoscopic retrograde; Child; Adolescent; Pancreaticobiliary disorders; Monitored anaesthesia care

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INTRODUCTION

Therapeutic endoscopic retrograde cholangiopancreatography (ERCP) is an important modality for managing pancreaticobiliary diseases in adults. Over the past four decades, there have been technological advancements in non-invasive cross-sectional imaging modalities, including the development of magnetic resonance cholangiopancreatography (MRCP). MRCP replaced ERCP as a diagnostic method, but ERCP continues to be a preferred modality for therapeutic interventions in the pancreaticobiliary system.[1] After the first report of ERCP in a child in 1976, it has been used extensively in the paediatric population over time, establishing its role, with efficacy and safety comparable to adults.[2] However, most paediatric studies have been limited by small cohorts, largely due to the lower incidence of pancreatic and biliary diseases in children and the higher threshold to pursue invasive procedures in this population.[3] Over half of paediatric ERCPs are performed in teenagers, whose physical attributes more closely resemble those of young adults.[4] Most studies in paediatric patients are

from developed countries with limited reports from low- and middle-income countries.[1]

As such, this study aims to investigate the procedural indications, diagnostic, therapeutic, and safety outcomes of ERCP at a tertiary care academic center.

MATERIAL AND METHODS

This was a retrospective, descriptive single-centre study conducted at Shifa International Hospital, Islamabad. The endoscopy software database was searched to identify all patients aged 17 years or below who underwent ERCP for pancreaticobiliary indications between February 2013 and August 2019; the youngest patient identified during this period was 8 years of age, and all 45 eligible paediatric patients during this seven-year window were included consecutively. Indications were based on the combined clinical, laboratory and radiological findings at presentation. Patients were admitted to the day-care unit or general ward as appropriate. All ERCP procedures were performed by experienced gastroenterologists using an Olympus duodenoscope, under monitored anaesthesia care (MAC). Following an overnight fast, ERCP was performed in the prone or left-lateral position using a side-viewing adult duodenoscope (Olympus). All procedures were carried out under monitored anaesthesia care (MAC) using midazolam, nalbuphine and propofol. An anaesthesiologist continuously monitored each patient throughout the procedure using pulse oximetry, electrocardiography and supplemental oxygen as required. Standard biliary cannulation was attempted using a sphincterotome and guidewire. Where standard cannulation was unsuccessful and an impacted biliary stone was present at the ampulla or distal common bile duct, needle-knife papillotomy (NKP) was used as a secondary access technique at the endoscopist's discretion. Procedural findings and images were saved in the hospital endoscopy system. A printed copy of the ERCP report was issued to the parents/guardians. Patients were reviewed in the outpatient department on the day following discharge, with relevant laboratory tests for comparison with pre-procedure values.

All patients were observed by anaesthetists and the primary physician after the procedure. Patients were discharged on the same day when clinically and hemodynamically stable and reviewed in the outpatient department on the following day with relevant laboratory tests for comparison with pre-procedure values.

Cannulation was considered difficult if it took longer than five minutes, required more than five papilla cannulation attempts or required more than two pancreatic duct cannulations. When the patient had abdominal pain that was either new or worsened along with an increase in amylase that was at least reported three times the higher upper limit of what is considered the normal level for more than 24 hours after an ERCP, necessitating an extension of the hospital stay, it was determined that the patient had PEP (Post ERCP Pancreatitis). A drop in haemoglobin > 2 g/dl indicated post-procedure bleeding. According to established criteria, other adverse events such as perforations, cholangitis, and cardiopulmonary events were classified.

Endoscopic retrograde cholangiopancreatography findings and reports were stored in the hospital information system, with a printed copy issued to the parents/guardians for subsequent follow-up. Ethical approval for this retrospective record review was obtained from the Institutional Review Board of Shifa International Hospital, Islamabad. As only de-identified existing medical records were reviewed, a waiver of additional informed consent was granted by the IRB.

Clinical and procedural variables extracted retrospectively included age, sex, co-existing conditions, indication for ERCP, pre-procedure imaging, antibiotic prophylaxis, type and duration of the procedure, cannulation success, therapeutic interventions performed, post-procedure findings and any adverse events. Data were extracted by the study investigators onto a structured proforma from the electronic medical record and analysed using SPSS version 21 (IBM Corp., Armonk, NY). Continuous variables are presented as mean ± standard deviation with range, and categorical variables as frequencies and percentages.

RESULTS

Over the seven-year study period (February 2013 to August 2019), 45 ERCPs were carried out in 45 paediatric patients aged 8–17 years (mean 15.11±2.42 years). Of these, 30 (66.7%) were male and 15 (33.3%) were female (Figure 1). All procedures were performed using an Olympus adult duodenoscope. The mean procedure time was 35±10 minutes (range 30–50 minutes).

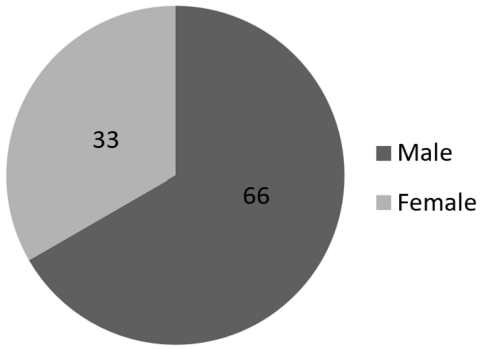

Figure-1: Sex distribution in percentage

Pre-procedure antibiotics were administered in 43 out of 45 patients (95.6%). Cannulation was successful in 44 of 45 patients (97.8%), and the desired procedure was completed in all 44. In one patient, cannulation was difficult, and the procedure was terminated; repeat ERCP was advised but the patient was lost to follow-up.

The most common indications for ERCP in our cohort were cholestatic LFTs (9 cases, 20.0%), pancreatic duct (PD) stone (5 cases, 11.1%), common bile duct (CBD) stone (5 cases, 11.1%), dilated common bile duct (4 cases, 8.9%), recurrent pancreatitis (3 cases, 6.7%), obstructive jaundice (3 cases, 6.7%), pancreatic divisum (3 cases, 6.7%), CBD stricture (2 cases, 4.4%), and 14 further indications each occurring in a single patient (2.2% each): pancreatic fistula, post liver-transplant biliary leak, post liver-transplant anastomotic stricture, dilated pancreatic duct with CBD stone, biliary colic, cholestatic LFTs with cholangitis, removal of a pancreatic-duct stent, pancreatic duct stricture, filling defect in CBD, cutaneous biliary fistula, and post liver-transplant dilated CBD (Figure 2).

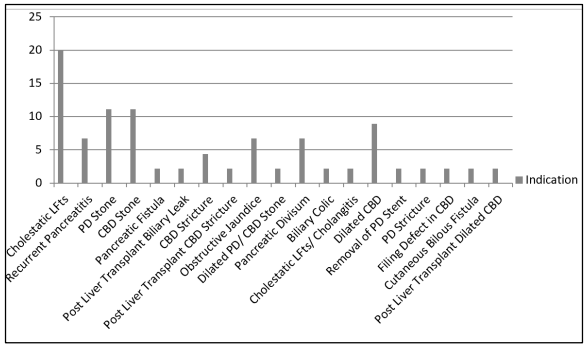

Figure-2: Percentage of Frequency of Indication.

Pre-procedure imaging was done in 28 out of 45 patients (62.2%), which included ultrasound, computed tomography scan (CT), or magnetic resonance cholangiopancreatography (MRCP).

ERCP was performed for diagnostic indications alone in 7 of 45 patients (15.6%) and with therapeutic intent in the remaining 38 (84.4%). Multiple therapeutic interventions were carried out in several patients. Standard biliary sphincterotomy was performed in 29 of 45 patients (64.4%); in a further 3 patients (6.7%) a previous sphincterotomy was already in place. Combined biliary and pancreatic sphincterotomy was performed in 6 patients (13.3%) and a small-to-medium biliary sphincterotomy in 4 patients (8.9%). Needle-knife papillotomy was used as a secondary access technique in 3 patients (6.7%).

Selective common bile duct cannulation was performed in 31 of 45 patients (68.9%) and selective pancreatic duct cannulation in 4 patients (8.9%); both ducts were cannulated in 9 patients (20.0%). Cannulation failed in 1 patient (2.2%). Endoprosthetic stent placement (biliary or pancreatic) was performed in 22 of 45 patients (48.9%). No patient in the cohort developed post-ERCP pancreatitis (PEP), clinically significant post-procedure bleeding (haemoglobin drop > 2 g/dL), perforation, cholangitis or any cardiopulmonary adverse event according to the criteria defined above. Two minor adverse events (4.4%) were observed and were considered non-procedural in origin: an antibiotic-related skin rash following the pre-procedure dose, and a self-limiting episode of epistaxis. Both were managed conservatively. Post-procedure diagnosis is shown in table 1.

Table-1: Final ERCP findings and therapeutic interventions.

Post ERCP diagnosis	Frequency	Percent
CBD sludge	2	4.4
PD stones	4	8.9
CBD stone removed and stent placed	12	26.6
CBD stricture dilated and stent placed	9	20.0
Pancreatic stenting	3	6.6
Biliary Leak / stent	1	2.2
Primary Sclerosing Cholangitis	1	2.2
Attempted ERCP	1	2.2
Pancreatic Divisum	1	2.2
Normal	7	15.6
External compression due to lymphadenopathy	2	4.4
Dilated CBD stent placement	2	4.4
Total	45	100.0

DISCUSSION

Our findings support the view that ERCP can be performed safely and effectively in older children and adolescents at a centre with experienced adult endoscopists. The ERCP complication rate in adults is acceptable when the procedure is carried out by an experienced endoscopist.[5] Due to several considerations, including the relatively low prevalence of disorders needing ERCP and the perception that the treatment is technically challenging in children, experience with ERCP in the paediatric population has been limited. Furthermore, there is a lack of clarity on the safety and indications of ERCP in the paediatric population. Only a small number of paediatric gastroenterologists obtain enough training in modern endoscopic techniques, including techniques like ERCP. Adult gastroenterologists typically fill this gap[6]. A practical limitation in many centres is that paediatric duodenoscopes are rarely available in adult endoscopy units. Current guidance recommends a paediatric duodenoscope for children weighing less than 10 kg or under 12 months of age; beyond this threshold, an adult diagnostic or therapeutic

duodenoscope is considered suitable[7]. In our cohort, all patients were aged 8 years or above, and an adult duodenoscope was used in every case without any tracheal impressions, airway obstruction or requirement for endotracheal intubation.[6]

Choledocholithiasis and acute or chronic pancreatitis are the most prevalent indications for ERCP in Western nations, but congenital choledochal cysts are the most frequent indication in Eastern countries (Japan, Korea, and India).[8–11]

In paediatric endoscopy, conscious or profound sedation as well as topical anesthesia have proven to be a secure substitute for general anesthesia.[12] However, general anaesthesia is sometimes required in paediatric ERCP because of procedural complexity, duration and smaller anatomy. Selective biliary cannulation (SBC) is the most challenging initial step and is performed in children using techniques comparable to those in adults, with practical constraints related to scope and accessory sizes. The cannulation success rate in our cohort (97.8%) is comparable to that reported in earlier paediatric series.

A substantial proportion of patients in our cohort underwent more than one therapeutic intervention during the same ERCP session, such as sphincterotomy with stone extraction or sphincterotomy followed by placement of a biliary plastic stent.

Cannulation success was achieved in 44 of 45 ERCP procedures (97.8%). Cholestatic LFTs were the most frequent indication for ERCP, followed by CBD and PD stones. Adverse events were observed in two patients (4.4%); both were minor, non-procedural in origin, and managed conservatively. The clinical indications observed in our cohort are broadly comparable to those reported by Otto et al.[11] However, their larger series of 231 children provides a more robust comparator for indication patterns and complication rates.

This study has several limitations. First, its retrospective single-centre design and modest sample size limit the generalisability of the findings, which may not extend to other settings with different referral patterns, peri-procedural protocols or endoscopist experience. Second, follow-up was short because the centre functions as a tertiary referral hub; consequently, data on late complications, recurrence of the presenting illness and longer-term outcomes are not available. Third, not all medical records contained complete anthropometric data (e.g., weight, BMI percentile), which precluded subgroup analyses by body size. Fourth, only children aged 8 years or above underwent ERCP during the study period, so the findings cannot be extrapolated to younger children or to those weighing less than 10 kg. Fifth, no paediatric duodenoscope was available, and only adult duodenoscopes were used. Finally, the study did not employ a standardised paediatric ERCP-complication grading system (such as the Cotton or AGREE criteria), and complications were ascertained from the medical record rather than by blinded re-review.

Within these limits, our findings suggest that diagnostic and therapeutic ERCP, when carried out by experienced adult gastroenterologists in a high-volume centre, can be performed safely and effectively in children aged 8–17 years, with a complication profile broadly similar to that reported in adult and adolescent series.

Conclusion: In this retrospective single-centre study, ERCP performed by experienced adult gastroenterologists using an adult duodenoscope under monitored anaesthesia care appeared to be a safe and effective option for selected children aged 8–17 years with pancreaticobiliary disorders. As the cohort consisted predominantly of adolescents and the study was retrospective with a relatively small sample, larger prospective multicentre studies including younger children are required before these findings can be generalised.

In this retrospective single-centre cohort, ERCP performed by experienced adult gastroenterologists using an adult duodenoscope under monitored anaesthesia care was safe and clinically effective for the diagnosis and management of pancreaticobiliary disorders in children aged 8–17 years. No serious procedure-related complications were observed. Larger, multicentre studies, including younger children, are needed to further define the safety and effectiveness of paediatric ERCP in this region.

Conflict of Interest: None.
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AUTHORS' CONTRIBUTION

All authors contributed equally.

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