

Multidisciplinary Approach In Pediatric Gastrointestinal And Liver Diseases

Samama Asghar Chohan

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Muhammad Sohaib

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Talat Ali

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Muhammad Awais*

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan & University of East London
+447440356462

Muzammil Saif

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Abdul Ahad Wakeel

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Haris Patafi

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Ali Hassan

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Alishba Shahid

Department of Pathobiology & Biomedical Sciences, Faculty of Veterinary & Animal Sciences MNS University Of Agriculture Multan

Abstract

Author Details

Keywords: Multidisciplinary Approach, Pediatric Hepatology, Pediatric Gastroenterology, Gastrointestinal Disease, Liver Disease, Clinical Management, Nutrition Support, Patient Outcomes

Received on 15 Apr 2026

Accepted on 09 May 2026

Published on 19 May 2026

Corresponding E-mail & Author*:

Muhammad Awais*

University of East London
+44744035642

It is a collaborative model approach that facilitates the timely diagnosis, individualised treatment, long-term follow-up and better outcomes for patients.

Some children may experience both gastrointestinal and liver disease, types and severity of disease may vary, it may be a chronic process, and may be difficult to diagnose. Conditions like chronic abdominal pain, malabsorption syndromes, inflammatory bowel disease, congenital liver diseases and acute liver failure should be evaluated in a thorough manner using advanced lab and imaging tests in addition to a thorough examination. The following diagnostic procedures are biochemical analysis, serological, endoscopy, histopathology, molecular genetics and radiology analysis. Improvements with regards to abnormal liver (wonders such as development of ultrasonography, interventional radiology) and inflammatory bowel disease (intestines) evaluation (fecal calprotectin). Genetic testing is now a standard test to discover liver diseases that have genetic causes such as PFIC and Alagille, so that the disease can be diagnosed

early and treated. The use of a multidisciplinary approach is specific in chronic and complex conditions of the children. IBD, chronic liver disease and biliary atresia thrive on teamwork among a number of disciplines of the healthcare team. Pediatric gastroenterologists have a central role in diagnosis and therapeutic planning and hepatobiliary surgeons have a role in procedures like Kasai portoenterostomy and liver transplantation. Radiologists provide diagnostic imaging and interventions using diagnostic imaging and pathologists are capable of providing confirmation of disease by histology. Clinical lab scientist aid in diagnosis through various interpretation of biochemical, hematological, immunological and molecular results. A new specialist nursing team is responsible for providing continuity of care, monitoring and education for the patient and a psychologist for emotional and/or behavioural responses to chronic conditions. This care system enhances the care and treatment delivery capabilities to help ensure compliance with treatments and promote better lifestyle and patient care. Somewhat appropriate use of Peds gastroenterology therapy would be nutrition care. Gastrointestinal-related disorders and liver diseases often present with nutritional issues such as malnutrition, growth failure and micronutrient deficiency in children. The assessment of nutritional status will be made by nutritionist and the ones who will be involved in the provision of a different range of interventions such as the enteral feeding, exclusive enteral nutrition or parenteral support. However in Crohn's disease in children, one nutrition approach is therapeutic: exclusive enteral nutrition (EEF) which lowers inflammation and growth of the intestine while being proven to be sustainable and effective. Treatment of celiac disease is simply diet therapy - a gluten-free diet. They highlight the importance of having dietitians integrated into children's multidisciplinary teams to be able to work on disease control, in parallel with nutritional rehabilitation, which the dietitian plays. Pediatric gastroenterology and hepatology is undergoing a transformation because of new technologies. The use of AI, molecular diagnostics and telemedicine is growing as tools to assist in diagnosis, treatment decisions and for monitoring in the long-term. AI imaging has a potential to help in early detection of conditions of the small and large bowel in newborns and telemedicine to patients who need an ongoing Specialist Service. Biologic therapy and combination therapy have made therapy available choices for severe inflammatory bowel disease and FMT could be a therapy option for

some paediatric diseases. Innovations showcase how the world of multidisciplinary care is evolving and its significance to the new Precision Medicine.

Introduction

The digestive tract and liver are affected by a variety of issues caused by pediatric gastrointestinal and liver diseases. These problems can be things like bowel syndrome or bad diseases like inflammatory bowel disease. Children with these conditions often have symptoms like abdominal pain, nausea, vomiting, fatty or pale stool, poor weight gain. Children are constantly growing up so if they have a problem with their digestive tract or liver it can affect them for a long time. It can affect how they grow, how they think and how they feel about things. In the few years people have started to realize that pediatric gastrointestinal and liver diseases are too complicated for just one kind of doctor to handle. Now we know that we need a team of doctors and other people to take care of kids with these problems. The multidisciplinary approach includes pathologists, laboratory technologists, pediatrician, radiologist, gastroenterologist and nurses. Sometimes we also need psychologists and social workers to help the kids and their families. Each member of the doctor's team contributes to child's well-being [1]. Their responsibilities include figuring out the problem, taking pictures of inside of children's body, assisting with nutrition, and promoting wellbeing. This approach ensures that children receive all support they require. For children with conditions like inflammatory bowel diseases, biliary atresia, and autoimmune hepatitis, it is essential to have a multidisciplinary approach. These kids need to be taken care of for a time and they need to be checked on a lot. They might need surgery. They might need special food to help them grow. They also need people to talk to so they can feel better about being sick. New medical tools, like endoscopy, molecular diagnostics and liver transplantation are also helping us take care of kids with these problems. Working together as a team can help us determine what is wrong, improve child condition, and ensure their health and safety. Ensure that the child's family is involved and knowledgeable about how to aid in child recovery. The responsibility of caring children with gastrointestinal and liver disease is a large one that requires the collaboration of many people. Children's body needs to be taken into account, as well as their diet, growth and feelings. The treatment of pediatric gastrointestinal and liver disease is complicated, but a team approach can make a significant impact.[2]

Concept of a multidisciplinary approach to pediatric GI and liver diseases:

The multidisciplinary team approach (MDTA) is an important therapeutic strategy in modern medicine to counteract the fragmenting effects of sub-specialisation. While the 20th century trend towards sub-specialisation in medicine resulted in an unprecedented accumulation of scientific and medical expertise, it also resulted in the division of care and difficulties in managing patients with complex, multifaceted health issues. The MDTA addresses this problem by grouping a variety of expertise (such as transplant surgeons, geneticists, psychologists and obstetricians) together. This "cooperative approach" allows the condition to be treated from a multidisciplinary perspective, rather than focusing on specific symptoms. Pediatric care has emphasized the importance of multidisciplinary care especially for children with gastrointestinal and liver disease. The complexity of these conditions is great, with options ranging from long term disorders like bowel disease, liver cirrhosis and stomach problems to life-threatening ones. Due to the complexity of these conditions, it is crucial for various health care professionals to work together. Due to the advancement of medicine, a single cannot handle all aspects of these conditions. Therefore it is advised to collaborate with gastroenterologist, hepatologist, pathologist, nurses and psychiatrist for child health care. Multidisciplinary approach has been shown to have significant benefit in improving the health outcomes and quality of life for children in

gastrointestinal and liver diseases . Monitoring , nutritional management ,emotional support and timely medical and surgical intervention are often required for children's with long term condition. The use of multidisciplinary approach care has been shown to lead to disease control, improve growth and fewer complications , according to studies. Multidisciplinary approach management can be beneficial for children with bowel disease or chronic liver disease to optimize their nutrition and ensure their health. Multidisciplinary care also helps use healthcare resources efficiently. By reducing hospital admissions preventing disease complications and minimizing emergency interventions multidisciplinary care can lower healthcare costs.Although setting up clinics may require initial investment evidence suggests that wellstructured multidisciplinary care is cost-effective in the long term. Kids and their families are also more satisfied with care. In care, where parental involvement is crucial coordinated care enhances communication builds trust and improves adherence to treatment plans. Overall the multidisciplinary care model is highly effective for managing GI and liver diseases. It addresses not the medical but also the nutritional, developmental and emotional needs of the child. Multidisciplinary care plays a role in providing comprehensive care for kids with GI and liver diseases and its benefits extend to improved health outcomes, quality of life and patient satisfaction. Multidisciplinary care is essential for kids, with conditions and its team-based approach ensures that they receive complete care.[3]

Roles of key specialists in Multidisciplinary pediatric GI and Liver care:

Pediatric Gastroenterologists:

As a central care manager pediatric gastroenterologists have helped children with gastroenteritis and liver disease. They conduct themselves in terms of their role:

Understanding of lab/intake studies is included in thorough medical check-ups.

Procedure execution and analysis of endoscopic procedures (e.g., esophagogastroduodenoscopy, colonoscopy, polypectomy, foreign body removal)

If relevant, including improvement and changes in individualized treatment plans that incorporate medications, dietary and or behavioral approaches.

Routine and long term disease monitoring, progress and interpretation of results to see the development

This knowledge is crucial to help differentiate organic and functional gastrointestinal issues, the most appropriate diagnostic methods, and the initiation of evidence based treatments and cure.

Pediatric Hepatologists

Child hepatologists concentrate on timely identification and control of liver disease either acute or chronic conditions, including:

Determination of newly born and children's jaundice, hepatitis, cholestasis, and liver failure

Take control measures of autoimmune disease, metabolic disorders, genetic liver disease and infection that affect liver such as alpha-1 antitrypsin deficiency , progressive familial intrahepatic, cholestasis and wilson disease.

Evaluation and arrangement for liver transplantation comprising donor and recipient assessment periprocedural administration and long term immunosuppression cooperation with transplant surgeons , image guided surgeons and pathologist for complicated patients.

Investigation and implementation Emerging biomarkers and cure for the liver diseases.

Dietitians and Nutritionists

Nutrition is a corner stone in the management of pediatric gastrointestinal and liver diseases: nutritional therapist and specialist.

Determine the state of nutrition, nutritional frame development and nutritional deficiency/surplus problems.

Personalization and/or customization of dietary plans, addition and elimination of dietary plans (e.g. lactose free diet for the lactose intolerant) and their purposeful use of exclusive enteral nutrition (EEN) in Crohn's disease, and concentrated/dietetic formulas in metabolic disorders and hepatic failure.

- Track and tackle associated with micro-nutrient insufficiency (see above)
- Raise food modification awareness, feeding habits and emphasize compliance

Provide some involvement to explore the food-soil and food-micro biome relationship.

Radiologists and imaging specialists:

Radiologists play a crucial role in non surgical investigation and supervision:

- Their duties involve performing and results making of abdominal ultrasound, magnetic resonance imaging (MRI) , Doppler ultrasonography, CT scans and professional studies like MR and elastography.
- They diagnose structural abnormalities (example given, biliary atresia, portal hypertension and malrotation) through imaging technology, instruct operative processes and tracking disease status or feedback to therapy.
- work with physicians to make an appropriate decision which imaging technology has to adopt, balancing diagnostic yield and radiation exposure.

Pediatric surgeons and hepatobiliary surgeons:

Invasive expertise is very important where the condition wants the operative procedures.

- perform procedures such as liver biopsy for cirrhosis and hepatitis, Endoscopic retrograde cholangiopancreatography (ERCP) for bile duct obstruction, percutaneous trans-hepatic cholangiography (PTC) for detection of blockage and Diagnostic laparoscopy for biliary Artesia evaluation, removal of unwanted masses and perform very crucial procedures like liver transplant etc.
- Work with gastroenterologists and hepatologists for better treatment and long term follow up
- Take a part in multidisciplinary tumor boards for liver cancers such as hepatoblastoma in children

Interventional radiologists:

Image guided surgeons give us appropriate replacement of surgery through minimally invasive techniques

- Image guided biopsies, drainage of abscess and management of vascular complications after liver transplants
- portal vein intervention for angio plasty and stent placement, embolization procedures to control liver bleeding and treatment of vascular malformation
- They team up with surgical and medical teams for complex cases

Benefits include small incisions, faster recovery, reduced hospital stay and low risk compared to open surgery.

Pathologists and Laboratory medicine:

Pathologists provide a very accurate diagnosis by the analysis on tissue level.

- Explanation of liver and gastrointestinal biopsies, detect features of any abnormality like autoimmune hepatitis, IBD, celiac disease and other metabolic disorders.
- detection of non-invasive biomarkers for disease activity and prognosis (e.g. ALT for liver cell injury, AST for liver inflammation and GGT that often increase in cholestatic and biliary diseases)
- work with other medical teams for betterment in the treatment of liver and gastrointestinal diseases

Pharmacists and medication management:

Pharmacists guarantee secure and efficient pharmacotherapy.

- Prescribing and tracking of immunosuppression and other biological medications in view of pharmacokinetics and potential drug interactions.
- Spread awareness about the constancy of medicine, side effects of drugs, their management and immunization schedule.
- Take a part in clinical trials and pharmacogenomic research.

Psychologists, Social workers, and Mental health professionals:

Persisting gastrointestinal and liver disease have a very strong psychological impact on patients

- Estimation and administration of anxiety, depression, body image concerns and other related challenges
- support for coping strategies, family dynamics and school functioning.
- combination of behavioural involvement such as supportive therapies
- Facilitation of transition to child care and support programs.

Nurses and care coordinators:

Nursing staff and care takers are the anchor of multidisciplinary care

- Spread awareness, symptom monitoring and analysis of vital body function and provide a sudden response to acute issues.
- coordinate appointments, referrals and communication among the medical teams and also are the bridge between patients and the doctors.
- Deliver prescribed medicine to the patient and also do a post operation care
- Advocate for patients and family needs, make sure the continuity and the standard of treatment

Genetics and Metabolic specialists:

Genetic and metabolic evaluation is very important for specific liver and gastrointestinal disorders

- Detection and counselling for genetic conditions such as Wilson disease, alagille syndrome and PFIC).
- Instruction on genetic testing, family screening and reproduction planning
- Take a part in research on genotype and phenotype correlation and their appropriate therapies.

Percentage of roles played by different fields of medical sciences in Multidisciplinary approach in paediatrics gastrointestinal and liver diseases:

Sr. No.	Field of medical science	Approx. roles %	Main contribution	References
1	Pediatric Gastroenterology & Hepatology	35-40%	Overall diagnosis, endoscopy, hepatology management, coordination of care	American academy of pediatrics
2	Pediatric Surgery / Hepatobiliary Surgery	15-20%	Corrective surgery, Kasai procedure, liver transplantation	Pakistan kidney and liver institute

3	Nutrition & Dietetics	10-15%	Nutritional assessment, enteral/parenteral feeding, growth support	NASPGHAN nutrition support guidelines
4	Radiology & Interventional Radiology	10-15%	Ultrasound, MRCP, biopsies, drainage and vascular interventions	Society of pediatric radiology
5	Pathology & Laboratory Medicine	5-10%	Liver biopsy interpretation, biomarker and laboratory analysis	American association for clinical chemistry
6	Pediatric Nursing Care	5-10%	Monitoring, medication administration, patient and family education	Society of pediatric nurses
7	Other Specialties (Genetics, Infectious Disease, Immunology, Endocrinology)	20%	Management of associated systemic disorders	MDPI diagnostics

Above reference links are mentioned in reference outline at the end of the review article.[[24](#),[25](#),[26](#),[27](#),[28](#),[29](#),[30](#)].

GI and liver condition :

multidisciplinary management Children with inflammatory bowel diseases (IBD) prevalence and presentation worldwide pediatric IBD, which includes Chron's diseases(CD),ulcerative colitis (UC), and unclassified IBD ,is becoming more recognized, with as many as 25% of case presenting in childhood or adolescence .
Diagnostic approach

Clinical assessment : The presence of chronic diarrhea , abdominal pain , weight loss ,rectal bleeding and extra-intestinal manifestation (arthritis , skin , liver) is possible.

Laboratory test : includes CBC , inflammatory marker (ESR , CRP) ,fecal prolectin (which can be highly sensitive to GI inflammation) and serological panels.

Diagnostic imaging : includes MRI enterography ,ultrasound and endoscopy along with biopsy to provide a definitive diagnosis and diseases mapping .

Multidisciplinary Approach: includes nutrition assessment by dietitian , anxiety and depression screening by psychiatrist and stricture consultation by surgeon.

Management strategies :

Medical Therapy: We usually start with an approach and then add more treatments if we need to. So we begin with aminosalicylates. If that does not work we use corticosteroids. Then we use immunomodulators like azathioprine and methotrexate.

If the patient still needs help we use biologic agents including antiTNF α therapies, vedolizumab and ustekinumab.

Nutritional Therapy: For kids with Crohn's disease we often try something called exclusive enteral nutrition or (EEN) for short. This is usually the treatment we try to get the disease under control. It works well and helps kids grow and heal their intestines.

Surgical Intervention: We only do surgery when the other treatments do not work or when there are problems like abscesses or perforation. Sometimes we also do surgery when kids are not growing like they should be.

Psychosocial Support: Taking care of someone with this disease is not about the medicine. We also need to make sure they take their medicine like they are supposed to do in school and get ready to take care of themselves when they are older.

Clinics: It is really helpful when we have clinics with a team of people who all work together to help patients, with inflammatory bowel disease or IBD. This helps people take their medicine like they are supposed to. They do not have to go to the hospital as much. It also makes it easier for them to switch to adult doctors when they get older.

Gastroesophageal reflux disease (GERD):

A child with gastroesophageal reflux disease (GERD) experiences persistent vomiting of stomach contents that returns to the child, leading to complications or symptoms. Contrast this with normal infant reflux (blowing): It is prolonged, painful and may have implications on growth or respiratory function.

Key facts

Early years: Infancy or early childhood.

Primary indications: Continual vomiting, troublesomeness, and unremarkable weight gain.

Prematurity, neurological impairment, and hiatal hernia are all potential risk factors.

Standard therapies: Eating habits, acid-reducing drugs.

Potential issues: Esophagitis, feeding intolerance, and aspiration. Symptoms may vary.

Pathophysiology and causes

Pediatric GERD involves the failure of the lower esophageal sphincter, which is a muscle ring that separates the esophagus from the stomach and prevents it from relaxing or closing properly. Regurgitation of acid or non-acidic gastric contents occurs as a result of this. In infants, factors such as immature sphincter control, delayed gastric emptying, or anatomical abnormalities (such as hiatal hernia) contribute to increased susceptibility. In contrast to transient physiologic reflux, GERD causes disturbances in feeding and sleeping patterns, as well as growth and development.

Symptoms and diagnosis

Infants may experience vomiting, irritability, coughing or arching backwards after feeding. The symptoms of asthma-like wheezing, heartburn, chest pain, regurgitation, chronic cough, or other symptoms may affect older children. The initial step in diagnosing illness is a history and physical examination; those who are persistent or

severe may require endoscopic testing, impedance monitoring through the esophageal pH, manometry to measure acid exposure and motility.

Management

The treatment focuses on decreasing reflux episodes and managing acid exposure. Initial stages involve smaller, more frequent feedings, upright re-evaluation after meals, and thickened formula or breast milk. Material is not additive. For complex or confirmed GERD, pharmacists may prescribe only H₂-receptor antagonists or proton-pump inhibitors as pharmacologic treatments. Surgery, commonly called fundoplication, may be a viable option in the event of medical therapy failure or complications.

Prognosis and complications

Respiratory problems in infants tend to disappear as their esophageal function increases, typically by 12-18 months. The presence of persistent pediatric GERD can result in Barrett's, stricture, or esophagitis, which can also impact other respiratory illnesses like chronic cough or aspiration pneumonia. A combination of early detection and targeted management tends to result in favorable long-term outcomes.

Celiac disease in children:

Pathophysiology and presentation

Celiac disease is an autoimmune enteropathy that is caused by gluten ingestion in individuals who are genetically vulnerable. Pediatric presentation range from common malnutrition (diarrhea, failure to thrive) to uncommon symptoms (anemia, delayed puberty, neuropsychiatric issues). Diagnostic approach

- Serology : The screening test that is preferred is tissue transglutaminase IgA, followed by endomysial antibody (EMA) for confirmation.
- Non-biopsy diagnosis: ESPGHAN guidelines permit the non-biopsy diagnosis of children with TGA -IgA 10x upper limit of normal and positive EMA in a second sample, as a guidelines.
- Genetic test : genetic test is not mandatory and HLA- DQ2/DQ8 testing is supportive.
- Biopsy : if there is equivocal serology or atypical presentation, biopsy is necessary .

Management

- Gluten-free diet: A gluten free diet that is governed by proper protocol should have lifelong support from a dietitian to help educate and monitor.
- Evaluation : regularly evaluate growth, nutritional status and any other autoimmune disease.
- Multidisciplinary approach : Involves the use of psychologist and social worker to address adherence issues and school accommodations, additionally.

Recent advances

- Non – invasive biomarker : current research on serological and genetic marker for diagnosis and monitoring.
- Molecular biology : understanding the role of gut bacteria in disease pathology and potential treatment.

Acute and Chronic liver failure in children

Definition and etiologies

Pediatric acute liver failure (PALF) occurs when there is no known history of liver disease, leading to sudden loss of hepatic function and often with the development of

disorders such as coagulopathy and encephalopathy. Progressive diseases that cause chronic liver failure include metabolic disorders, biliary atresia (low blood pressure) , autoimmune disease (high blood count) Diagnostic and management approach

- Rapid assessment : A multidisciplinary team of specialists, including hepatologists, intensivists, neurologist and transplant surgeons to carry out rapid assessment for diagnosis and management.
- Etiology specific therapy : antivirals for hepatitis, immunosuppression for the autoimmune type; chelation for Wilson disease .
- Supportive care: For coagulopathy , encephalopathy ,for renal dysfunction; and for infections.
- Nutritional advise : Enteral feeding is preferred method for nutrition support , but parental nutrition can be utilized as needed.
- Liver transplant : Up to 80% of children with biliary atresia or PALF may require liver transplantation , which requires early referral to appropriate centers for treatment.

Recent Progress

- Prognostic models : improved tool for forecasting the need for transplant and better outcomes, with molecular adsorbent recirculating system(MARs) and plasma exchange serving as bridge to extracorporeal liver support.
- AI : Several machine learning models have been developed for preoperative planning , donor selection criteria and outcome predictions.

Biliary atresia:

Definition and facts

In infants , there is biliary atresia, which is the condition where the bowel movements and excretory system are blocked and scarred. If untreated leads to cholestasis , cirrhosis and liver failure.

Symptoms and causes

- The initial indication of biliary atresia is the appearance of yellow skin and eye whites , which are caused by excess toxins. This condition is commonly known as jaundice. infant with biliary atresia usually develop jaundice between the ages of 3 and 6 weeks . The causes if biliary atresia are unknown to experts to diagnose the conditions, doctors will require information about the baby medical and family history, physical examination statuses, and a range of tests however.

Diagnosis

- After taking the medical history and family history ,or a series of test , if the test results indicate that they may have biliary atresia ,surgery is the next in confirming the diagnosis.
- Laboratory test : elevated direct bilirubin ,GGT and liver enzymes.

Treatment

- To treat the biliary atresia , doctors performed the kasai procedure and then carry out surgery followed by liver transplant in most cases. With the development of better treatment , more than 80 to 90 percent of infant with biliary atresia survive until adulthood.

Eating, diet and nutrition

- A possible cause of malnutrition in children with biliary atresia is reduce bacterial flow to gut and liver damage and this condition also caused impaired glucose uptake.

Nonalcoholic fatty liver disease in children

Overview

Childhood obesity and NAD are both factors that contribute to chronic liver disease .the illness can manifest as either simple steatosis and non alcoholic steatohepatitis (NASH) which may progress fibrosis , cirrhosis and even liver transplantation . Obesity affect 40-70% of population,with children with being around 10%.

Epidemiology and clinical significance

Insulin resistance, hypertension, obesity, and dyslipidemia are all markers of NAFLD, atype of hepatic metabolic syndromes. While often asymptomatic, it is also associated with potential cardiovascular disease and long term liver problems.

Pathogenesis of pediatric NAFLD

Multiple-hit Hypothesis NAFLD is explained as a result of “multiple exposure model” that include the development of insulin resistance, increase vulnerability to oxidative stress, genetic predisposition, gut microbiota changes , and environmental factors.
Accumulation of hepatic Fat and insulin resistance:

Insulin resistance and fat accumulation in Hepatic cells are linked.

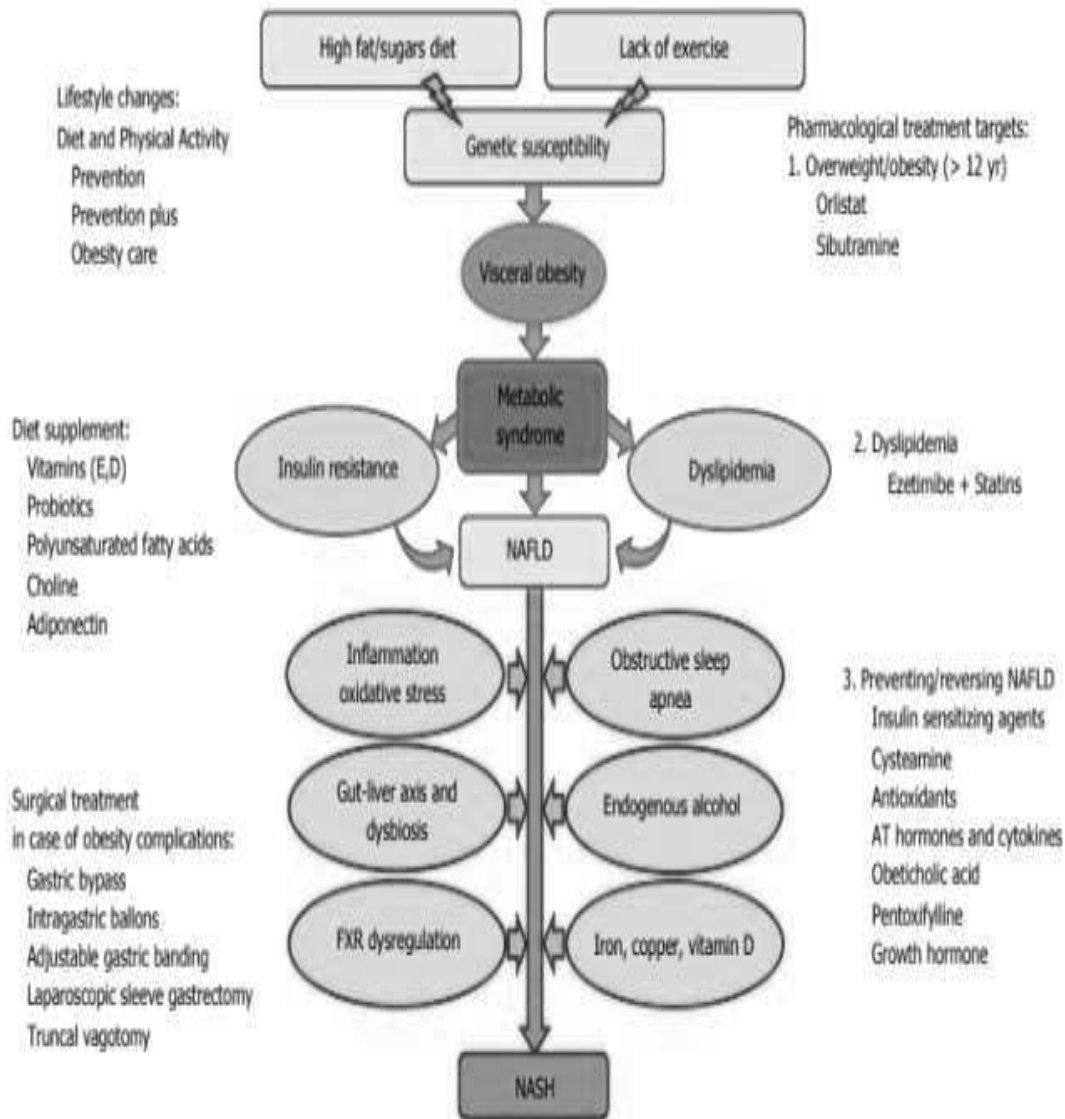


Figure 1 Simplified cartoon of the multiple pathomechanisms involved in development and progression of non-alcoholic fatty liver disease, and proposed stepwise treatment options. NAFLD: Non-alcoholic fatty liver disease; NASH: Non-alcoholic steato-hepatitis; FXR: Farnesoid X receptor; AT: Adipose tissue.

When a person consumes more than the recommended daily intake, they accumulate triglyceride in their hepatocytes, which disrupts insulin signaling pathways and causes metabolic imbalance.

Role of Adipose tissue:

Activation of adipose tissue promotes inflammation through the activation or loss of certain immune cells, such as TNF-, leptin, and resistin.

Oxidative stress:

The formation of reactive oxygen species (ROS) due to mitochondrial dysfunction causes damage to hepatocytes, inflammation, and the subsequent development of NASH.

Dietary factors

The consumption of fructose and saturated fats can lead to an increase in lipogenesis, insulin resistance, and hepatic fat deposition, which can significantly impact disease.

Gut liver Axis and microbiota :

Endotoxins are able to enter the liver through immune pathways and gut microbiota that have changed due to increased intestinal permeability.

Genetic factors:

The susceptibility to NAFLD and its progression to ASH is linked to genetic polymorphisms like PNPLA3 and GPR120.

Other contributing factors:

Trace element imbalance (iron ,copper) Vitamin D deficiency, Endogenous alcohol production, Obstructive sleep apnoea and Ghrelin-GOAT system dysfunction

Clinical presentation

The majority of NAFLD patients do not show any symptoms. When present, signs include: Hepatomegaly Acanthosis nigricans Increased waist circumference Insulin resistance and obesity are frequently linked to these traits .

Diagnosis of NAFLD

Clinical and laboratory Assessment:

Children who are overweight /obese may be suspected of being overweight if :
Elevated ALT /AST Dyslipidemia, Hyperinsulinemia Disease is not excluded by typical liver enzymes

Imaging techniques:

Ultrasound (screening tool)

Quantitative analysis using MRI and MR spectroscopy is essential.

Elastography (fibrosis assessment):

Magnetic resonance elastography is showing promise in distinguishing steatosis from fibrosis

Liver biopsy:

Liver biopsy is the most reliable method for diagnosis and staging, but its invasiveness and sampling variability are limitations.

Non- Invasive Biomarkers:

APRI, FIB-4, and pediatric NAFLD score are the markers of fibrosis . Cytokeratin – 18 Adipokines and uric acid Novel markers (zoulin, cathepsin D)

Differential diagnosis

Other reasons for liver disease should also be avoided:

Wilson disease

Autoimmune hepatitis

Celiac disease

Metabolic disorders

Management of pediatric NAFLD

Life style medication (first -line):

Weight loss Healthy diet Regular physical activity Behavioral modifications enhance insulin sensitivity and liver histology

Dietary and nutritional supplements:

Vitamin E and D Omega -3 fatty acids Probiotics Choline The benefits of these are not uniform and tend to be temporary.

Pharmacological therapy

Targets include:

Insulin resistance (metformin) Oxidative stress (antioxidants) Inflammation (pentoxifylline) FXR agonists (obeticholic acid) Evidence remains limited in children .

Research and Future Direction

Non-invasive diagnostic tools GUT micro biome modulation Genetic and molecular targets Novel pharmacological therapies

Conclusion:

the multi-disciplinary approach has been incorporated in the child care as an integral part. It's a system where all of the pediatric gastroenterologist, hepatologist, radiologist, pathologist, surgeon, nutritionist, laboratory technologist, nurse, psychologist, pharmacist and other health care providers can work together for the best diagnosis and best care possible for the child. Early diagnosis and intervention can be achieved through team working and coordination, nutrition support, psychological counselling and advanced therapeutic interventions as per need of the children. New techniques like endoscopy, MRI, elastography, molecular testing, biomarkers and minimally invasive procedures have also added to the capacity to diagnose diseases when early and to minimise complications. Multidisciplinary management has been important in managing disease, nutrition and reducing long term mortality and hospital admissions in various diseases such as inflammatory bowel disease, celiac disease, biliary atresia, acute liver failure and nonalcoholic fatty liver disease. Also, patient education and family involvement play an important part in a successful treatment and patients with chronic diseases might require emotional support and life-long follow-up. The multidisciplinary approach also provides health care professionals with improved information for clinical decision making and elimination of unnecessary procedures to other medical teams and improve communication. The advent of artificial intelligence, non-invasive biomarkers, genetic testing and personalized medicine in recent years has led to the emergence of many new opportunities to enhance the services available for gastrointestinal and hepatobiliary health care for children. Advancements in artificial intelligence, non-invasive biomarkers, genetic testing and personalized medicine in recent years have created numerous new opportunities to improve the services available in gastrointestinal and hepatobiliary health care for children. There are many issues to be solved, including access to care, late diagnosis and treatment, as well as costs, but the future is bright and promising, with a lot of research and innovation, as well as collaborative care, in the works. However, in the majority of cases, any approach that is based on the multi-disciplinary treatment of gastrointestinal and liver disease in children will be one of the best and most reliable ways to treat the disease and to endeavor to ensure the overall growth, development and wellbeing of the child.^[1, 2, 3, 4, 5]

References:

- Omic International. (n.d.). *Pediatric gastroenterology: An overview of diagnosis and treatment*. <https://www.omicsonline.org/open-access-pdfs/pediatric-gastroenterology-an-overview-of-diagnosis-and-treatment.pdf>
- Springer. (2024). *Navigating the transition: A multidisciplinary approach to pediatric care*. <https://link.springer.com/article/10.1007/s00383-024-05789-8>
- Eventact. (n.d.). *The European training syllabus*. https://events.eventact.com/eap/style/ESPGHAN_Syllabus.pdf
- PreventionGenetics. (n.d.). *Progressive familial intrahepatic cholestasis (PFIC) and Alagille syndrome panel*.

- <https://www.preventiongenetics.com/tests/progressive-familial-intrahepatic-cholestasis-pfic-and-alagille-syndrome-panel>
- European Journal of Transplantation. (n.d.). *An overview on pediatric living donor liver transplantation*. <https://www.eujtransplantation.com/article/view/393>
- Springer. (2024). *Exclusive enteral nutrition for treating pediatric Crohn's disease*. <https://link.springer.com/article/10.1007/s12519-024-00835-w>
- NASPGHAN. (n.d.). *Research agenda for pediatric gastroenterology, hepatology and nutrition*. <https://naspghan.org/files/documents/pdfs/position-papers/NASPGHANResearchAgenda.PDF>
- Child Liver Disease Foundation. (n.d.). *Interventional radiology management of pediatric portal venous pathologies*. <https://childliverdisease.org/interventional-radiology-management-of-pediatric-portal-venous-pathologies/>
- Frontiers in Pediatrics. (2020). *Fecal calprotectin in combination with standard blood tests*. <https://www.frontiersin.org/journals/pediatrics/articles/10.3389/fped.2020.609279/full>
- Surgery Science. (n.d.). *Long-term follow-up of children with biliary atresia after Kasai procedure*. <https://www.surgeryscience.com/articles/1182/9-2-2-687.pdf>
- Springer. (2022). *Psychological aspects of inflammatory bowel disease in children*. https://link.springer.com/chapter/10.1007/978-3-031-14744-9_50
- LinkedIn. (n.d.). *The role of a GI certified nurse coordinator: The new frontier*. <https://www.linkedin.com/pulse/role-gi-certified-nurse-coordinator-new-frontier-milena-eidcc>
- American Association for the Study of Liver Diseases. (n.d.). *Pediatric acute liver failure: From prompt recognition and management*. <https://www.aasld.org/liver-fellow-network/core-series/clinical-pearls/pediatric-acute-liver-failure-prompt-recognition>
- American Journal of Roentgenology. (2003). *Sonographic diagnosis of biliary atresia in pediatric patients*. <https://www.ajronline.org/doi/10.2214/ajr.181.5.1811387>
- Journal of Surgical Research. (2024). *Timing of Kasai procedure for biliary atresia: An analysis*. <https://www.journalofsurgicalresearch.com/article/S0022-4804%2824%2900381-0/abstract>
- Quantitative Imaging in Medicine and Surgery. (2024). *Artificial intelligence aids doctors in diagnosing necrotizing enterocolitis*. <https://qims.amegroups.org/article/view/143040/html>
- MDPI. (2022). *Patient satisfaction and perceived quality of care with telemedicine in pediatric gastroenterology*. <https://www.mdpi.com/2036-7503/14/2/25>
- Springer. (2020). *Combination of biological agents in moderate to severe pediatric inflammatory bowel disease*. <https://link.springer.com/article/10.1007/s40272-020-00396-1>
- Clinical Gastroenterology and Hepatology. (2019). *Recommendations for successful transition of adolescents with gastrointestinal disease*. <https://www.cghjournal.org/article/S1542-3565%2819%2930495-1/fulltext>
- MDPI Medicina. (2024). *A review of fecal microbiota transplantation in children*. <https://www.mdpi.com/1648-9144/60/11/1899>
- ESPGHAN. (2020). *New guidelines for the diagnosis of paediatric coeliac disease*. https://www.espghan.org/dam/jcr:a82023ac-c7e6-45f9-8864-fe5ee5c37058/2020_New_Guidelines_for_the_Diagnosis_of_Paediatric_Coeliac_Disease_ESPGHAN_Advice_Gui
- Springer. (2020). *The treatment of pediatric inflammatory bowel disease with biologic therapies*. <https://link.springer.com/article/10.1007/s11894-020-00773-3>

- Nature Pediatric Research. (2023). *Sustainability of biologic treatment in paediatric patients with Crohn disease*. <https://www.nature.com/articles/s41390-023-02913-7.pdf>
- American Academy of Pediatrics. (n.d.). *What is a pediatric gastroenterologist?* <https://www.healthychildren.org/english/family-life/health-management/pediatric-specialists/pages/what-is-a-pediatric-gastroenterologist.aspx>
- Pakistan Kidney and Liver Institute. (n.d.). *Paediatric gastroenterology*. <https://pkli.org.pk/paediatric-gastroenterology/>
- NASPGHAN. (n.d.). *Nutrition support guidelines*. <https://naspghan.org/professional-resources/clinical-guidelines/>
- Society for Pediatric Radiology. (n.d.). *Society for Pediatric Radiology*. <https://www.pedrad.org/>
- American Association for Clinical Chemistry. (n.d.). *Pearls of laboratory medicine*. <https://www.aacc.org/clinical-chemistry-trainee-council/trainee-council-in-english/pearls-of-laboratory-medicine>
- Society of Pediatric Nurses. (n.d.). *Society of Pediatric Nurses*. <https://www.pedsnurses.org/>
- Children's Hospital of Philadelphia. (n.d.). *Gastrointestinal disorders and psychology team approach*. <https://www.chop.edu/conditions-diseases/gastrointestinal-disorders-and-psychology-team-approach>
- ScienceDirect. (2019). *Pediatric gastroenterology and hepatology review*. <https://www.sciencedirect.com/science/article/pii/S1096719219301507>
- Pakistan Journal of Health Sciences. (2023). *Pediatric gastroenterology-related study*. <https://www.thejas.com.pk/index.php/pjhs/article/view/3606>
- Journal of Clinical Investigation. (2024). *Pediatric gastrointestinal and liver disease research*. <https://www.jci.org/articles/view/186422>
- PubMed. (2020). *Pediatric gastroenterology-related article*. <https://pubmed.ncbi.nlm.nih.gov/32886957/>
- World Journal of Gastrointestinal Endoscopy. (2017). *Pediatric gastrointestinal endoscopy review*. <https://www.wjgnet.com/1948-5190/full/v9/i1/1.htm>
- Diagnostics (MDPI). (2024). *Diagnostic advances in pediatric gastroenterology*. <https://www.mdpi.com/2075-4418/14/8/852>
- Guandalini, S. (Ed.). (2019). *Pediatric gastrointestinal and liver disease* (E-book ed.). Elsevier. https://books.google.com/books?hl=en&lr=&id=eB_DwAAQBAJ
- Diagnostics (MDPI). (2024). *Pediatric diagnostic research*. <https://www.mdpi.com/2969096>
- ScienceDirect. (n.d.). *Best practice and research clinical obstetrics and gynaecology*. <https://www.sciencedirect.com/journal/best-practice-and-research-clinical-obstetrics-and-gynaecology>
- Diagnostics (MDPI). (2023). *Diagnostic approaches in pediatric diseases*. <https://www.mdpi.com/2075-4418/13/14/2437>
- Frontiers in Public Health. (2023). *Multidisciplinary approaches in pediatric gastrointestinal and liver disease*. <https://www.frontiersin.org/journals/public-health/articles/10.3389/fpubh.2023.1315392/full>
- PMC. (2014). *Pediatric liver disease review article*. <https://pmc.ncbi.nlm.nih.gov/articles/PMC3886036/>
- Frontiers. (2023). *Multidisciplinary approaches in pediatric gastrointestinal and liver disease*. <https://www.frontiersin.org/research-topics/56355/multidisciplinary-approaches-in-pediatric-gastrointestinal-and-liver-disease/magazine>
- Sage Journals. (1999). *Histopathological approach to metabolic disorders*. <https://journals.sagepub.com/doi/abs/10.1007/s100249900038>

- Current Opinion in Gastroenterology. (2006). *Hepatobiliary pathology*.
https://journals.lww.com/co-gastroenterology/FullText/2006/05000/Hepatobiliary_pathology.3.aspx
- ScienceDirect. (n.d.). *Pathology of liver disease*.
<https://www.sciencedirect.com/science/article/pii/B9780702066979000030>
- Oxford University Press. (2018). *Paediatric gastroenterology, hepatology and nutrition*. <https://books.google.com/books?hl=en&lr=&id=2UVvDwAAQBAJ>
- NASPGHAN. (2005). *Celiac disease in children: Clinical guidelines*.
<https://onlinelibrary.wiley.com/doi/abs/10.1002/j.1536-4801.2005.tb00917.x>
- American Academy of Pediatrics. (2005). *Celiac disease in children*.
<https://publications.aap.org/pediatrics/article-abstract/116/6/e754/63010>
- ScienceDirect. (2001). *Diagnosis and treatment of celiac disease*.
<https://www.sciencedirect.com/science/article/pii/S0016508501251877>
- Pain Medicine Journal. (n.d.). *Diagnosis and treatment of biliary atresia*.
<https://painmedicine.org.ua/index.php/pnmdcn/article/view/289>
- ScienceDirect. (2023). *Controlled trials in celiac disease*.
<https://www.sciencedirect.com/science/article/pii/S0016508523049818>
- Encyclopaedia Britannica. (n.d.). *Gastroesophageal reflux disease (GERD)*.
<https://www.britannica.com/science/gastroesophageal-reflux-disease>
- Mayo Clinic. (n.d.). *GERD: Symptoms and causes*.
<https://www.mayoclinic.org/diseases-conditions/gerd/symptoms-causes/syc-20361940>
- Johns Hopkins Medicine. (n.d.). *Gastroesophageal reflux disease (GERD)*.
<https://www.hopkinsmedicine.org/health/conditions-and-diseases/gastroesophageal-reflux-disease-gerd>