American Journal of Pediatrics
2020; 6(3): 312-316
http://www.sciencepublishinggroup.com/j/ajp
doi: 10.11648/j.ajp.20200603.33
ISSN: 2472-0887 (Print); ISSN: 2472-0909 (Online)

Case Report

A 17-year-old Girl with Crohn's Disease: A Case Report

Ida Ayu Putu Purnamawati, I Putu Gede Karyana, I Gusti Ngurah Sanjaya Putra, Ni Nyoman Metriani Nesa*, I Gusti Lanang Sidiartha

Department of Child Health, Medical Faculty of Udayana University, Sanglah Hospital, Denpasar, Indonesia

Email address:
metriani_nesa@yahoo.co.id (Ni N. M. Nesa)

*Corresponding author

To cite this article:
Ida Ayu Putu Purnamawati, I Putu Gede Karyana, I Gusti Ngurah Sanjaya Putra, Ni Nyoman Metriani Nesa, I Gusti Lanang Sidiartha. A 17-year-old Girl with Crohn's Disease: A Case Report. *American Journal of Pediatrics*. Vol. 6, No. 3, 2020, pp. 312-316.
doi: 10.11648/j.ajp.20200603.33

Received: July 1, 2020; **Accepted**: July 13, 2020; **Published**: August 4, 2020

Abstract: The prevalence of inflammatory bowel disease (IBD) in worldwide exceeded 0.3%. The highest prevalence of Crohn's disease is reported in Germany (322 per 100.000). The incidence and prevalence of IBD relatively low in Asia. In Indonesia, the case of IBD are rarely found. Reported a 5.2% of cases of Crohn's disease and from the rest of the total cases colonoscopy at Cipto Mangunkusumo Hospital. In majority population, patients with Crohn's disease usually diagnosed in their 20s and 30s. However 5-10% of all cases occur early in paediatric. The aim of our case report was to describe clinical presentation, laboratory, imaging study and histopathology finding of Crohn's disease. A 17-year-old girl had reccurent bloody stool, recurrent diarrhea, recurrent stomatitis, pale, abdominal pain, weight loss, and did not have her period since 16-year-old. Physical examination showed cachexia appearance, old man face, prominent costae, tenderness at abdominal palpation, muscle wasting, severe malnutrition, and abnormal puberty stage. The laboratory findings revealed micrositic hypochromic mild anemia, positive fecal test, faecal calprotectin >2.100 ug/g, and hypoalbuminemia. The abdominal Computerized Tomography (CT) scan showed suspect inflamation process in the intestine. The colonoscopy and Esophago Gastro Duodenoscopy (EGD) finding revealed multiple colon ulcers with skip lesions and pangastritis superficialis. The histopathologic finding revealed an active chronic gastritis and colitis. Patient was diagnosed as Crohn's disease, urinary tract infection, mild microcytic hypochromic anemia due to chronic dissease, secondary amenorrhea, severe marasmic malnutrition condition III rehabilitation phase. Patient got enteral nutrition with 6 weeks, corticosteroid to induce remission for 10 weeks (include tapering dose), omeprazole, antibiotic for urinary tract infection, albumin, vitamin and micronutrient for malnutrition management. After 10 weeks of treatment she had remission. Diagnosis of Crohn disease in adolescent girl is not easy to establish. However, some symptom of upper and lower gastrointestinal tract, extraintestinal manifestation like secondary amenorhea, faecal calprotectin level >2.100 ug/g, along with support finding from colonoscopy and EGD which revealed multiple ulcers in colon with skip lesions, pangastritis superficialis and histopathology result which showed an active chronic gastritis and colitis can be helpful to diagnose the case.

Keywords: Adolescent, Crohn's Disease, Inflammatory Bowel Disease

1. Introduction

The prevalence of inflammatory bowel disease (IBD) in worldwide exceeded 0.3% [1]. The incidence and prevalence of IBD relatively low in Asia. In Indonesia, the case of IBD are rarely found [2]. There was 5.2% of cases of Crohn's disease and from the rest of the total cases colonoscopy at Cipto Mangunkusumo Hospital. In majority population, patients with Crohn's disease usually diagnosed in their 20s and 30s. However, 5-10% of all cases occur early in paediatric [3]. Crohn disease in adolescent girl have impact in fertility and pregnancy. Here, it is very important to confirm this

disease earlier.

Establishment of diagnosis of Crohn disease is not simple. Thus, adequate knowledge is needed to differentiate with other disease. This case report aimed to describe clinical presentation, laboratory, imaging study and histopathology finding of Crohn's disease in 17-year-old girl and its associated problem.

2. Case Illustration

A 17-year-old girl was referred from A hospital in East Nusa Tenggara with peptic ulcer disease, hematochezia, suspect haemorrhoid interna with differential diagnosis colorectal cancer and crohn disease, cystitis, uterine hypogenesis. The patient had bloody stool since ten days before admitted. The stool`s colour was reddish like fresh blood with a black lump. Bloody stool occurred nine times/day. The bleeding was recovered spontaneously. The patient had diarrhea since one month before she admitted. The stool was yellowish, volume approximately one small glass, with mucus, no blood, without nausea and nor vomitting. She also complained reccurent abdominal pain that occured since six months before admitted. She felt the pain was twisting like sensation. There was severe weight loss since a year ago from 40 kilograms to 25 kilograms. The patient had her menarche when she was 14 years old, and used to have her period regularly. However since a year ago she did not have her period. She had normal urination.

She had history of recurrent admission to hospital because of bloody stool, diarrhea, anemia and severe stomatitis. Her Human Immunodeficiency Virus (HIV) status was negative. The ultrasonograph examination revealed cystitis, uterine hypogenesis. She got red blood cell transfusion at previous hospital.

She was the second child. There were no history of the same disease among the parent and other family. However, some people smoking around their house. The patient denied that she often consumed sweetener or sweet, but she used to eat meat and rarely eat vegetable or fruit.

On physical examination, she appeared severely ill and alert. Head examination showed old man face with pale conjungtiva. There were prominent costae with normal heart and lung examination. There was no abdominal distention, with increased bowel sound, with tenderness in the right hypochondrial and suprasymphysis region, skin turgor was normal. There were baggy pants, and muscle wasting in extremities. Puberty stage was abnormal and nutritional status was severe malnutrition. Laboratory findings revealed leukocytosis 37.62 K/µL (neutrophil 33.08 K/µL (87.9%); lymphocyte 8.81 K/µL (3.32%)), hemoglobin 8.7 g/dL (Mean Corpuscular Volume (MCV) 72.71 fL; Mean Corpuscular Hemoglobin (MCH) 23.53 pg; Mean Corpuscular Hemoglobin Concentration (MCHC) 32.36 g/dL), hematocrit 26.89%, platelet 485 K/µL, C-Reactive protein (CRP) 97.46 mg/L, aspartate aminotransferase (AST) 78.6 U/L, alanine aminotransferase (ALT) 16.9 U/L, albumin 1.9 g/d, estradiol 24 pg/ml with normal electrolyte examination. The urine test revealed pH 7 leukocytes +3, protein +1, blood +3. The faecal test revealed, macroscopic within normal limit. And from microscopic faecal test revealed leukocyte 8-10/large field of view, no eritrocytes, no vegetative, no cyst. Level of Carcinoembryonic Antigen (CEA) was 8.5 ng/mL, and Faecal Calprotectin >2.100 ug/g. The result of Anti Nuclear Antibody (ANA) profile with Crohn's disease and not associated with other autoimmune disease. The blood culture and urine culture showed no growth.

Abdominal CT scan with contrast findings revealed inflamation process in the intestine, without mass, normal uterus, no abnormalities were found on other organ. The colonoscopy and EGD revealed multiple colon ulcers with skip lesions. The ulcers located at sigmoid, colon ascenden, appendix, caecum with ileum valve involvement and pangastritis superficialis. The biopsy of the colon and gaster tissue revealed an active chronic gastritis (lymphocytes and plasma cells inflammation with mild neutrophils activity on lamina propia) and colitis (lymphocytes and plasma cells inflammation with on lamina propia and neutrophils activity on crypt). There were no Helicobater pylori found.

Based on history taking, physical examination and investigation, she was diagnosed with Crohn's disease, urinary tract infection, mild microcytic hypochromic anemia suspect due to chronic disease, secondary amenorrhea, severe marasmic malnutrition condition III rehabilitation phase.

The patient was fasting due to hematochezia and given total parenteral nutrition. The patient was given folic acid, vitamin, and zinc for malnutrition management, paracetamol for pain killer, omeprazole, ceftriaxone for urinary tract infection, albumin, and steroid (methylprednisolone) 2 mg/kg/day plan for 2 weeks.

On the fourteenth day of hospitalization there was no bloody diarrhea. Thus, the patient was started enteral feed with semi elemental formula. Antibiotic for urinary tract infection was discontinued and other pharmacological therapy for severe malnutrition and Crohn's disease was continued. The patient was observed for vital signs (awareness, respiratory rate, pulse rate, axillary temperature, oxygen saturation), fluid balance, weight gain, refeeding syndrome, the adherence and possibility of drug side effects and faecal routine test (to see if there is still any bleeding in gastrointestinal tract). After 10 weeks of treatment she recovered well.

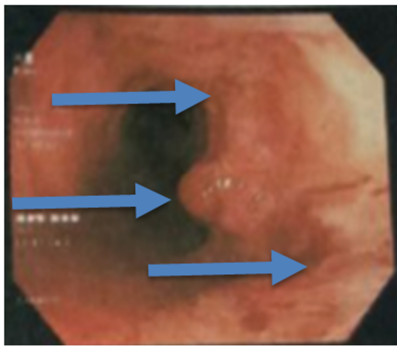

Figure 1. *Colonoscopy showed multiple colon ulcers with skip lesion.*

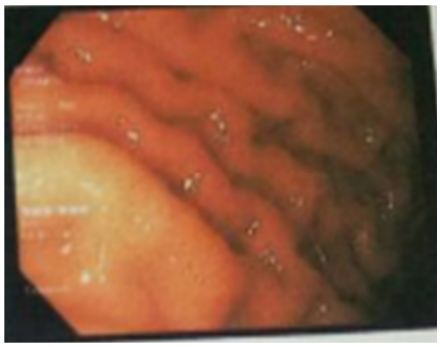

Figure 2. *Esophago Gastro Duodenoscopy showed pangastritis superficialis.*

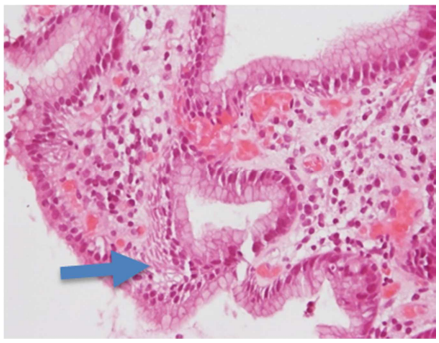

Figure 3. *Histopatology of colon descenden. Lamina propria look swollen. There were inflammatory cell of neutrophils, eosinophils, basal limphoplasmacytosis from lamina propria until submucosal. Most of neutrophils ~~infiltrated~~ crypt's epitel.*

3. Discussion

Crohn's disease is a relapsing systemic inflammatory disease, mainly affecting the gastrointestinal tract with extraintestinal manifestations and associated immune disorders [4]. Crohn's disease is grouped with inflammatory bowel disease [4, 5]. The prevalence of inflammatory bowel disease in worldwide exceeded 0.3%, which is highest prevalence of Crohn's disease reported in Germany (322 per 100.000) [1]. In majority population, patients with Crohn's disease usually diagnosed in their 20s and 30s, however 5-10% of all cases occur early in paediatric [3]. Crohn disease is equally distributed between gender. In this case, the patient was a seventeen years old girl with Crohn's disease, which symptoms had occured about a year earlier.

Crohn's disease is caused by genetic alteration, genome wide association studies and meta-analysis have identified 71 suspectibility loci for Crohn's disease on 17 chromosomes so far [4]. Current research shows that among those with Crohn disease, 2.2% to 16.2% have a first-degree relative who also has the disease [5]. Environmental factors also play big role in Crohn's disease, smoking are best studied among them. Early tobacco use significanly increase the risk of developing Crohn's disease [4, 5]. Consumption of convenience food (excessive amount of sugar and polyunsaturated fats), sweetener and sweet, fats, oil, meat protein were positively associated with Crohn's disease [4, 5, 6]. In this patient, there were no history of the same disease among the parent and other family, and there were no history of tobacco use from the patient and the parent. However, some people smoking around their house. The patient denied that she often consumed sweetener or sweet, but she used to eat meat and rarely eat vegetable or fruit.

Crohn's disease is a clinical diagnosis that integrates history and physical findings with objective data from imaging and laboratory studies, including histopathology, and should neither be based nor excluded on any onevariable or result [4]. Chronic diarrhea is the most common presenting symptom, while abdominal pain and weight loss are seen in about 70% and 60% of patients. Unexplained anemia and blood and/or mucus in the stool may be seen [7]. Non-specific gastrointestinal symptom mimicking inflammatory bowel disease could be found averagely 7.7 years before diagnosis of Crohn's disease. This is significant longer compared to the time needed to establish ulcerative colitis (average 1.2 years) [3, 7]. In this case, the patient had clinical manifestation bloody stool, chronic diarrhea with tenderness in right and left hypochondrium, anemia and severe malnutrition. Clinical manifestation was recurrent with history of severe stomatitis in a year previously.

The laboratory finding in Crohn disease revealed anemia, elevated erythrocyte sedimentation rate (ESR). Fecal marker, such as calprotectin (FC) and lactoferrin (FL) can be measured in stool. Commonly inflammation marker in Crohn disease are increase ESR and CRP. CRP level had positive correlation with activity of the disease. Increased CRP level >45 mg/dL showed that clinician decided to colectomy [8]. Anemia was present in approximately 70% of patient, and ESR was elevated in nearly 75% of children who have moderate to severe disease [9]. In this case, the laboratory finding revealed anemia, elevated CRP and increased fecal calprotectin.

Radiologic examination in Crohn disease play important role. CT scan asses for intestinal wall thickening and this is important to assessment of urgent complication of IBD [9]. In this case, Abdominal CT scan with contrast findings revealed suspect inflamation process in the intestine.

Colonoscopy with multiple biopsy specimens is well established as the first line procedure for diagnosing colitis. The most useful endoscopic features of Crohn's disease are discontinuous involvement, anal lesions and cobble stoning [5, 10]. In this case, Colonoscopy and EGD study revealed involvement at the lower gastrointestinal tract (multiple ulcus colon with skip lesion at sigmoid, colon ascenden, appendix, caecum with ileum valve involvement) and upper gastrointestinal tract (pangastritis superficialis).

Crohn's disease involving the upper gastrintestinal tract is almost invariably accompanied by small bowel involvement, gastric biopsies may be useful when a patient has colitis unclassified [10]. Biopsies from different regions should be done, focal chronic inflammation and patchy chronic inflammation, focal crypt irregularity and granulomas are the generally accepted microscopic features wich allow a diagnosis of Crohn's disease [4, 5, 10]. Specimen obtained from surgery has higher diagnostic value compared to specimen obtained through endoscopy. Lesion in Crohn disease usually transmural, which is difficult obtained through

endoscopy. In this case, biopsies of the colon and gaster tissue revealed an active chronic gastritis and colitis. There was no granuloma.

Once the diagnosis of Crohn's disease is established, patients should be staging according to the Montreal classification and screened for extraintestinal manifestations and associated autoimmune diseases [4, 5]. The Montreal classification of Crohn's disease considered age of onset (A), disease location (L), and disease behaviour (B) as the predominant phenotypic elements (Table 1) [11]. In this case, the Montreal classification for this patient is A1 L3-4 B1. The age of onset was 16 years old, approximately one year before admitted to S hospital. This patient had severe malnutrition, which can be happened if there was any small intestine involvement [12]. There were no strictured, penetrated, or perianal disease detected in this patient. There were extraintestinal manifestations (secondary amenorrhea). Crohn disease in this patient not associated with other autoimmune disease.

Table 1. *Montreal classification for Crohn's disease [11].*

	Mountreal classification
Age of onset	A1 below 16 years old
	A2 between 17-40 years old
	A3 above 40 years old
Location	L1 ileal
	L2 colonic
	L3 ileocolonic
	L4 isolated upper disease
Behaviour	B1 non-stricturing, non-penetrating
	B2 stricturing
	B3 penetrating
	p perianal disease modifier

*"L4" is a modifier that can be added to L1-L3 when concomitant upper gastrointestinal disease is present.
** "p" is added to B1-B3 when concomitant perianal disease is present.

The patient had secondary amenorrhea, she had menarche when she was 14 years old, and used to have her period regularly, however since a year ago she did not have her period. Patient was checked estradiol level 24 ug/g appropriate with puberty stage (Tanner III). Gynecologic manifestation in young female may include genital manifestation, delayed puberty and menstrual irregularities. There is a lack study gynecologic manifestation in Crohn disease. Davis et al report in 85.7% cases of Crohn disease had menstrual problem included dysmenorrhea, vaginal bleeding and secondary amenorrhea. In 7 cases of Crohn disease, there was one case of secondary amenorrhea [13]. Patient with Crohn's disease tend to have low antimullerian hormone, which is produced by ovarian granulosa cells. Therefore, the fertility women with Crohn's disease lower than general population. The etiology remains unclear and contradictory. However, there was a hypothesis that chronic low-grade inflammation could be the one of mechanism that affect female fertility [14].

Treatment for Crohn's disease primarily depend on pharmacologic therapies, with surgical intervention when necessary. Corticosteroid is an antiinflammatory agents often used to aid induction of remission in Crohn disease patients, because it has rapid symptom relief and disease control effect. The National Co-operative Crohn's disease Study randomized 162 patients, achieving 60% remission with 0.5–0.75 mg/kg/day prednisone (the higher dose for more severe disease) and tapering over 17 weeks, compared to 30% on placebo [15]. It is usually combined with immunomodulator such as methrotexate, azathioprine, infliximab for long term therapy [4, 5]. Another study conduct by Haens revealed that combined immunomodulator was more effective than conventional steroid therapy for induction of remission and reduction of corticosteroid use in patients who had been recently diagnosed with Crohn's disease [16]. In this case, the patient was given methylprednisolone 2 mg/kg/days, it was given for 2 weeks.

Malnutrition is relatively frequent in Crohn's disease and might be severe. Nutrition support is frequently indicated. First principles of artificial nutrition can be applied effectively using the gut whenever possible. Parenteral nutrition should be considered to support of patient Crohn's disease in whom enteral feeding has failed or contraindicated [14, 17]. There were several causes of malnutrition in Crohn's disease, such as anorexia, malabsorption, increased intestinal losses and catabolic effects of systemic inflammation. Enteral nutrition leads to remission in approximately 60% of patients within 4–6 weeks. Remission rates with enteral nutrition range from 53% to 80%, which is higher than remission rates of placebo groups in most studies range from 18% to 40%. Therefore, a direct anti-inflammatory effect of enteral nutrition in active Crohn's disease is generally accepted. The therapeutic efficacy of enteral nutrition in active Crohn's disease is also suggested by results of recent studies demonstrating mucosal healing as well as a reduction in proinflammatory cytokines by enteral nutrition [17, 18]. Exclusive enteral nutrition is recommended as a first line therapy to induce remission in children with active luminal Crohn's disease. Duration exclusive enteral nutrition as induction therapy is usually 6-8 weeks [19]. Exclusive enteral nutrition with the duration minimum 6 weeks will give improvement to disease activity, weight recovery, biochemical remission and mucosal healing. Though the mechanism of enteral nutrition in reducing disease activity remain unknown [14, 20]. There are no difference in the remission rate when elemental and polymeric formulas given in the patient [14]. The superiority of total enteral nutrition in remission rates using Pediatric Crohn Disease Activity Index (PCDAI) as outcome measures at 6 weeks (15% vs 42%) respectively, p=0.035 [21]. In this case, the patient was given enteral nutrition as early as possible. The patient was given F75 at the first time, but changed to peptamen^{R} (extensive hydrolized whey protein formula) in rehabilitation phase.

4. Summary

A 17-year-old girl had reccurent bloody stool, recurrent diarrhea, recurrent stomatitis, pale, abdominal pain, weight loss, and did not have her period since 16-year-old. Physical examination showed cachexia appearance, old man face,

prominent costae, tenderness at abdominal palpation, muscle wasting, severe malnutrition, and abnormal puberty stage. The laboratory findings revealed microcytic hypochromic mild anemia, positive fecal test, faecal calprotectin >2.100 ug/g, and hypoalbuminemia. The abdominal CT scan revealed with suspect inflamation process in the intestine. The colonoscopy and EGD finding revealed multiple colon ulcer with skip lesions and pangastritis superficialis. The histopathologic finding revealed an active chronic gastritis and colitis. Patient was diagnosed as Crohn's disease, urinary tract infection, mild microcytic hypochromic anemia due to chronic dissease, secondary amenorrhea, severe marasmic malnutrition condition III rehabilitation phase. Patient got enteral nutrition with 6 weeks duration, corticosteroid to induce remission for 10 weeks (include tapering dose), omeprazole, antibiotic for urinary tract infection, albumin, vitamin and micronutrient for malnutrition management. After 10 weeks of treatment she got remission.

Acknowledgements

Special thanks to Ketut Mariadi Gastroenterologist and AA Ayu Ngurah Susraini, Anatomical Pathologist Consultant to contribute data of endoscopy and biopsy.

References

[1] Ng SC, Shi HY, Hamidi N, Underwood FE, Tang W, Benchimol EI, et al. Worldwide incidence and prevalence of inflammatory bowel disease in the 21st century: a systematic review of population-based studies. *The Lancet (online serial)*. Download at 17th June 2018. Access from: http://dx.doi.org/10.1016/S0140-6736(17)32448-0.

[2] Kelompok Studi Inflammatory Bowel Disease Indonesia. *Konsensus nasional penatalaksanaan inflammatory bowel disease (IBD) di Indonesia*. Jakarta: Perkumpulan Gastroenterologi Indonesia 2011.

[3] Duricova D, Burisch, Jess T, Rousseau CG, Lakatos PL. Age-related differences in presentation and course of inflammatory bowel disease: an update on the population-based literature. *Journal of Crohn's and Colitis.* Vol. 8, 2014, pp. 1351-61.

[4] Baumgart DC, Sandborn WJ. Crohn's disease. *Lancet*. 2012, pp. 1590-605.

[5] Mazal J. Crohn disease: pathophysiology, diagnosis, and treatment. *Radiologic Technology*. 2014, pp. 297-316.

[6] Sakamoto N, Kono S, Wakai K, Fukuda Y, Satomi M, Shimoyama T, et al. Dietary risk factors for inflammatory bowel disease a multicenter case-control study in Japan. *Inflammatory Bowel Disease*. Vol. 25, No. 2, 2005, pp. 154-63.

[7] Loftus EV Jr, Silverstein MD, Sandborn WJ, Tremaine WJ, Harmsen WS, Zinsmeister AR. Ulcerative colitis in Olmsted County, Minnesota, 1940-1993: incidence, prevalence, and survival. *Gut*. Vol. 46, N0. 3, 2000, pp. 336-43.

[8] Bossuyt X. Serologic markers in inflammatory bowel disease. *Clinical Chemistry*. Vol. 52, No. 2, 2006, pp. 171-81.

[9] Glick SR, Carvalho RS. Inflammatory Bowel Disease. *Pediatrics in Review*. Vol 32, 2011, pp. 14.

[10] Assche GV, Dignass A, Panes J, Beaugerie L, Karagiannis J, Allez M. The second european evidence-based consensus on the diagnosis and management of crohn's disease: definitions and diagnosis. *Journal of Crohn's and Colitis*. Vol. 4, 2010, pp. 7-27.

[11] Satsangi J, Silverberg MS, Vermeire S, Colomberl JF. The montreal classification of inflammatory bowel disease: controversies, consensus, and implications. *Gut*. Vol. 55, 2006, pp. 749-53.

[12] Freout T, Miossec C, Ngahou KB, Dejoie, Flamant M, Maillard O, et al. Ovarian reserve in young women of reproductive age with crohn's disease. *Inflammatory Bowel Disease*. 2011, pp. 1-8.

[13] Davis-Kankanamge CN, Bercaw-Pratt JL, Santos XM, and Dietrich JE, Crohn's disease and gynecologic manifestation in young females, *Journal of Pediatric and Adolescent Gynecology*. 2016, pp. 1-11.

[14] Alastair F, Emma G, Emma P. Nutrition in inflammatory bowel disease. *Journal Parenteral Enteral Nutrition.* Vol. 35, 2011, pp. 571-80.

[15] Dignass A, Assche GV, Lindsay JO, Lemann M, Soderholm J, Colombel JF. The second european evidence-based consensus on the diagnosis and management of crohn's disease: current management. *Journal of Crohn's and Colitis*. Vol. 4, 2010, pp. 28-62.

[16] Hoens GD, Baert F, Assche GV, Caeneppeel P, Vergauwe P, Tuynman H. Early combined immunosuppresion or conventional management in patients with newly diagnosed crohn's disease: an open randomised trial. Lancet. Vol. 371, 2008, pp. 660-7.

[17] Afzal NA, van der Zaag-Loonen HJ, Arnaud Battandier F, et al. Improvement in quality of life of children with acute Crohn's disease does not parallel mucosal healing after treatment with exclusive enteral nutrition. *Alimentary Pharmacology Ther*apy. Vol. 20, 2004, pp. 167–72.

[18] Yamamoto T, Nakahigashi M, Umegae S, et al. Impact of elemental diet on mucosal inflammation in patients with active Crohn's disease: cytokine production and endoscopic and histological findings. *Inflammatory Bowel Disease.* Vol. 11, 2005, pp. 580–8.

[19] Ruemmele FM, Veres G, Kolho KL, Griffiths A, Levine A, Escher JC et al. Consensus Guidelines of ECCO/ESPGHAN on The Medical Management of Pediatric Chron's Disease. *Journal of Crohn's and Colitis*. 2014, pp. 1-28.

[20] Grover Z, Muir R, Lewindon P. Exclusive enteral nutrition induces early clinical, mucosal and transmural remission in paediatric crohn's disease. *J Gastroenterol*. 2013; Download at 17th June 2018.

[21] Johnson T, Macdonald S, Hill S M, Thomas A, Murphy MS. Treatment of active Crohn's disease in children using partial enteral nutrition with liquid formula: a randomised controlled trial. *Gut*. Vol. 55, 2006, pp. 356-61.