

Clinical study of liver abscess

Krishnanand¹, Kurmi N.S.²

¹Dr. Krishnanand, Professor and Head, ²Dr. Narendra Singh Kurmi, Assistant Professor, both authors are affiliated with Department of Surgery, L.N. Medical College and J.K. Hospital, Bhopal, India.

Corresponding Author: Dr. Narendra Singh Kurmi, Assistant Professor, Department of Surgery, L.N. Medical College and J.K. Hospital, Bhopal, India. E-mail: krishnananddr@gmail.com

Abstract

Background: The aim of our study was to study general considerations, etiological and predisposing factors, symptoms and signs and various modalities of treatment of liver abscess. **Methods:** We have taken 60 cases having proven liver abscess. All data collected from these cases was compared statistically. A predesigned proforma was used to collect this information for individual case. All selected cases were studied upto discharge regarding the type of liver abscess and treatment modalities. **Results:** Amoebic liver abscesses were more common than pyogenic liver abscesses. Liver abscesses were more common in 5th decade followed by 6th decade. Liver abscesses were more common in males than females; Diabetes mellitus (35%) and Alcoholism (23.3%) were the most common predisposing factor in our study. Single abscess was a finding in 71.66% and multiple abscess in 28.33% of patients. **Conclusion:** The modern day ultrasound and other non-invasive imaging techniques had greatly revolutionized the diagnosis and management of the liver abscess. Conservative management with IV antibiotics and USG guided percutaneous aspiration of liver abscess are most frequent treatment modalities used now; with fewer complications.

Keywords: Amoebic liver abscesses, Diabetes mellitus, Alcoholism, Hypochondriac tenderness

Introduction

Liver abscess remains a formidable diagnostic and therapeutic problem, but significant studies have occurred in the management over the past decades. Delay in diagnosis remains a major determinant of the severity of the illness and outcome in amoebic and pyogenic liver abscess. Lack of familiarity with the clinical feature of these conditions on the part of clinician and failure to consider the diagnostic are among the most important factor contributing to continued morbidity and mortality [1].

Abscess formation with in the liver occurs in variety of circumstances and in response to different agents. Abscess of the liver may be pyogenic or parasitic in origin. With introduction to antibiotics, the incidence of pyogenic abscess of the liver has decreased to a greater extent. Liver abscess in the most common extraintestinal manifestation of amoebiasis. Hepatic amoebiasis is reported in 3-10% of afflicted patients. The incidence is high in tropical countries and is attributed to lack of proper sanitation and personal hygiene due to low socioeconomic conditions [2].

Pyogenic and amoebic liver abscess share many clinical features. Clinically the first diagnostic requirement is the demonstration of an abscess followed by demonstration of its nature. Until recently the diagnosis of liver abscess was dependent upon variable clinical criteria, characteristics of pus aspirated from abscess cavity or on a clinical response to appropriate chemotherapy. With the advent of imaging techniques such as ultrasound, CT scan, serological tests the diagnosis of liver abscess can be made early, rapidly and accurately. The management of hepatic abscess has been greatly influenced by advances in diagnostic imaging and interventional radiology [3,4].

Several factors such as different strains of *E. histolytica*, the patient susceptibility alcoholism and malnutrition predispose to the disease. Though a readily treatable disease; if untreatable can be potentially fatal leading to serious life complications like rupture into pleural, peritoneal or pericardial cavities.

Despite considerable attempts to distinguished two entities at the bedsides, no reliable clinical features exists that are specific for amoebic versus pyogenic

Manuscript Received: 5th February 2019
Reviewed: 13th February 2019
Author Corrected: 20th February 2019
Accepted for Publication: 23rd February 2019

Original Research Article

hepatic abscess [5,6]. The present study delves into etiology, clinical presentation; diagnostic; various risk factors; management & complications of liver abscess.

Materials and Methods

Type of study: Prospective

Method of collection of data- 60 cases of liver abscess selected randomly and studied. All data collected from this cases was compared statistically. A predesigned proforma was used to collect this information for individual case. All selected cases were studied upto discharge regarding the type of liver abscess and treatment modalities and followed up in OPD regarding post operative complications.

Selection of cases

Inclusion criteria: Patients with history and diagnostic features suggestive of liver abscess and its complication of age group 15 to 60 years of both male and female. Should have a liver abscess

Exclusion criteria: Liver disease like alcoholic hepatitis, viral hepatitis other than liver disease Liver abscess not detected on examination or radiologically. Patients who are not willing for specific investigations like USG, CT and aspiration of the abscess.

Statistical Analysis- The data of the present study were fed into the computer and after its proper validation, checking for error, coding and decoding were compiled and analysed with the help of SPSS 11.5 software for windows. Appropriate univariate and bivariate analysis and ANOVA (analysis of variance) for more than two means were carried out using t-test, calculated and tested. All means are expressed as mean + standard deviation. The critical values for the significance of the results were considered at 0.05 levels.

Material

1. Portable ultrasound unit: All the sonography procedures were performed with real time ultrasound guidance.
2. Antibiotics-
3. Aspiration needles:
4. Trolley settings:
5. Laparoscopic trolley

Methods: Diagnosis of liver abscess was done with help of clinical examination, x-ray and was confirmed by ultrasonography. In some patients CT scan was used. Various treatment modalities for liver abscess used

according to multiple factors such as site of abscess, size of abscess, pyogenic or amoebic, single or multiple. Specific criteria were made for modality of treatment to be used. After confirmation specific antibiotics was started.

According to specific criteria-

1. Conservative,
2. Percutaenous ultrasound guided needle aspiration
3. Ultrasound guided pigtail catheter drainage
4. Laparoscopic drainage of liver abscess- used for treatment.

Indications for Conservative management:

1. Abscess size less than/or equal to 5cm.
2. Right lobe abscess
3. Abscess responding to antibiotics within 72 hours.

All patients of amoebic liver abscess were given antibiotics as under.

Inj. Metronidazole 1000mg TDS IV (double Dose) For seven to fourteen days and followed by oral antibiotics. Tab. Ciprofloxacin 500mg BD. Metronidazole 400 mg TDS

All patients of pyogenic liver abscess were given antibiotics as under

Inj. Ceftriaxone 1gm. BD IV. For seven days
Inj. Metronidazole 500mg TDS IV for seven to fourteen days and followed orally Tab. Metronidazole 400mg TDS

After discharge, oral metronidazole was continued for 2-3 weeks depending on the regression

Indication for aspiration of abscess

1. Lack of improvement with subsidence of symptoms and signs in 72 hrs.
2. Abscess size more than 5 cm.
3. Large left lobe abscess
4. Multiple liver abscess

Laparoscopic drainage of liver abscess- Laparoscopic drainage of liver abscess can be done if any of the following criteria are present in a patients

1. Abscess that are not amenable to percutaneous drainage secondary to location
2. Coexistence of intra-abdominal disease that requires operative management
3. Concominant biliary/intra- abdominal disease
4. Failure of percutaneous aspiration
5. Failure of percutaneous drainage

Original Research Article

Open Surgical Drainage- In 2 patients open surgical drainage done due to rupture of liver abscess in peritoneal cavity; where typical transperitoneal approach is used. Abdomen opened with vertical midline incision.

All pus aspirated, warm saline wash given. Hemostasis confirmed; abdominal drain no 32 kept and secured. Closed in layers. Review USG done for each patient on post op day 3. Tube drain removed when output becomes minimal (<50cc.)

Results

- We have taken 60 cases from the wards of tertiary care centre having proven liver abscess. Amoebic liver abscesses were more common than pyogenic liver abscesses.
- The ratio of amoebic to pyogenic liver abscess was 1.72:1 (38 patients of amoebic liver abscess and 22 patients of pyogenic liver abscess.) Liver abscesses were more common in 5th decade followed by 6th decade. Liver abscesses were more common in males than females; male to female ratio was 7.57:1 (53 males and 7 females).
- Diabetes mellitus (35%) and Alcoholism (23.3%) were the most common predisposing factor in our study. Pain in abdomen was most consistent symptoms with 100% of patients followed by fever in 90%. Anorexia was present in 66.66% and malaise in 40%.
- Nausea, cough, jaundice was present in <20% cases. Right hypochondriac tenderness was the most persistent symptom with 93.33% followed by Pyrexia (>100F^o) in 70% cases. Tachycardia (Pulse >100/min) was present in 58.33%
- Leucocytosis (wbc>10000) was present in 61.66% as most consistent finding on blood investigations. SGOT/SGPT were increased in nearly 50% of cases.
- Anaemia (Hb<10mg/dl) was found in 45% and deranged PT in 35% of cases. Single abscess was a finding in 71.66% and multiple abscess in 28.33% of patients.

After studying sixty patients of liver abscess from ward of tertiary care centre, following observations has been made.

Table-1: predisposing and etiological agents in liver abscess.

S. No.	Predisposing and etiological agents	No of cases N=60	Percentage
1	Biliary tract disease	9	15.00%
2	Gastrointestinal tract pathology	6	10%
3	Diabetes mellitus	21	35.00%
4	Alcoholism	14	23.33%
5	No cause (idiopathic)	10	16.66%

In our study age wise distribution for liver abscess was highest in fifth decade of life (36.66%) followed by six decade with 25% and then by fourth decade (16.66%). Mean age in our study was 43.9 years. In our study Liver abscess is more preponderant in males than female as male are affected in 88.33% cases.

Table-2: Type of liver abscess

S. No.	Type of Liver abscess	No of case	Percentage
1	Amoebic abscess	38	63.33%
2	Pyogenic abscess	22	36.66%

Our study data analysis shows that liver abscess is most common in patients of Diabetes Mellitus (35%) followed by Alcoholics. Which clearly indicates that Amoebic abscess is a disease of developing countries with low socioeconomic conditions.

Table-3: Symptoms of liver abscess.

S. No.	Symptoms	No. of cases N=60	Percentage %
1	Pain	60	100
2	Fever	54	90
3	Nausea and vomiting	12	20
4	Anorexia	40	66.66
5	Malaise	24	40
6	Cough	8	13.33
7	Diarrhea	12	20.00
8	Jaundice	11	18.33

Symptoms of liver abscess are variable and cause difficulty in diagnosis. In our study pain in abdomen was most consistent symptom (100%) followed by fever in 90% cases. Anorexia was present in 66.6% cases. Cough, Diarrhea and jaundice were present in some patients with <20%.

Signs of liver abscess are not specific and it is difficult to arise at diagnosis only with clinical examination. However following signs when present should arouse a suspicion of liver abscess

Table- 4: Signs of liver abscess.

S. No.	Signs	No of cases N=60	Percentage %
1	Temp>100f	42	70%
2	Pulse>100/min	35	58.33
3	Icterus	11	18.33
4	Right hypochondriac	56	93.33
5	Hepatomegaly	7	11.66
6	Respiratory signs*	12	20

*Consolidation, Crepitations, Decrease air entry

Ultrasonography Findings

Table- 5: Lobes of liver affected-(site of abscess).

S. No.	USG findings	No. of cases n=60	Percentage
1	Solitary abscess	43	71.66%
	• Right lobe	37	61.66% (86.04%*)
	• Left lobe	6	10% (13.95%*)
2	Multiple abscess	17	28.33%
	• Right lobe	13	21.66% (76.47%#)
	• Both lobe	4	6.66% (23.52%#)

Table- 5: BSize of Abscess.

S. No.	Size of abscess	No. of cases	Percentage
1	Up to 5cm	18	30.00%
2	6cm to 10 cm	29	48.33%
3	11 cm to 15cm	11	18.33%
4	16 cm to 20 cm	02	03.33%

Our study shows that liver abscess was present in 71.66% cases as solitary liver abscess while 28.33% cases present with multiple liver abscess. Our study shows right lobe (61.66%) is more commonly affected than left lobe (10%). Both lobes were affected in 6.66% of cases. In our study most of the patients of liver abscess were of size between 6 to 10 cm. We performed CBC, LFT and PT of each patient on the day of admission and then when required. None of the liver function tests were diagnostic for liver abscess. However leucocytosis was the most consistent laboratory finding in our study with 61.66% cases. Minimum count was 12000/dl and maximum was 27000/dl. 45% of patients were having anaemia with Hb<10mg/dl. Albumin was less than 3mg/dl in 43.3% while PT was deranged in nearly 1/3rd patients.

Table-6: Different modalities of treatment of liver abscess.

S. No.	Type of treatment	No. of cases n=60	Percentage
1	Conservative	18	30.00%
2	Per cutaneous USG guided aspiration	27	45.00%
3	Per cutaneous USG guided drainage	8	13.33%
4	Laparoscopic drainage	5	08.33%
5	Open surgical drainage	2	03.33%

Table-7: Complication of Liver Abscess.

S. No.	Complication	No of cases N=60	Percentage
1	Septicemic shock	3	5.0%
2	Injury to surrounding structures	0	00%
3	Infection at drain site	1	1.6%
4	Pneumothorax	7	11.66%
5	Rupture into peritoneal cavity	0	00%
6	Death	1	1.6%

Discussion

Patients of liver abscess were studied for general parameters, etiological and predisposing factors, symptoms, signs, laboratory findings, radiological findings and various treatment modalities. Follow up of every patient was kept.

Rahimian J, Wilson T et al studied pyogenic liver abscess. They reviewed the data for patients over a 10-year period. The most common symptoms were fever, chills, and right upper quadrant pain or tenderness. The most common laboratory abnormalities were an

elevated white blood cell count. Seventy percent of the abscesses were in the right lobe, and 77% were solitary. *Klebsiella pneumoniae* was identified in 41% of cases in which a pathogen was recovered. The data suggest that *K.pneumoniae* has become the predominant etiology of pyogenic liver abscess and that mortality from this disease has decreased substantially [6,7]. Seeto RK, RockeyDC et al studied changes in etiology, management, and outcome of pyogenic liver abscess. Pyogenic liver abscess [PLA] remains most common in older patients, affected male and female patients with

Original Research Article

equal frequency. The most common known cause of PLA remains biliary tract disease, but the majority of patients with PLA were those in whom no underlying cause of PLA could be identified. Single PLA was more common than multiple PLA regardless of etiology. In this study, percutaneous catheter drainage (PCD) appeared to result in a higher cure rate than percutaneous needle aspiration (PNA). Surgical intervention as a primary mode of therapy has been almost completely replaced by less invasive approaches such as PCD/ PNA, but remains an important consideration in patients who fail these therapies. Although PLA was once considered a fatal disease, the prognosis is now excellent. Their findings were consistent with our study [7].

Siu LK, Yeh KM et al observed that rapid detection of the hypervirulent strain that causes this syndrome allows earlier diagnosis and treatment, thus minimising the occurrence of sequelae and improving clinical outcomes. The role of anaerobic bacteria in the etiology of pyogenic liver abscess was not fully recognized. In 11 years Sabbaj J, Sutter VL et al encountered 25 cases of anaerobic liver abscess, which represent 45% of all liver abscesses seen in the same period. Blood cultures, usually reported as negative in this condition, but were positive in 54% of cases.

Anaerobes recovered from abscess contents or blood inpatients included anaerobic or microaerophilic streptococci, *Bacteroides*, *Fusobacterium*, and *Actinomyces*. A literature survey disclosed an additional 165 cases of anaerobic liver abscess. Commonly described "sterile" abscesses undoubtedly reflect the lack of adequate anaerobic transport and culture techniques. Surgical drainage remains the cornerstone of treatment, but antimicrobial therapy is also important. Failure to recover existing anaerobic organisms may result in inappropriate drug therapy [8,9].

Ochsner A, DeBakey M et al did an analysis of forty-seven cases with review of the literature. The sex incidence of pyogenic hepatic abscess reveals a preponderance of occurrence in the male, 67.4 per cent in the collected series and 70.2 per cent in the authors'. Pyogenic liver abscess can be caused also by direct extension from contiguous suppurative processes, trauma, and by transportation of microorganisms through the hepatic artery from distant foci [10].

The Bantu inhabitants of Durban suffer from an acute, ulcerative type of amoebic colitis frequently associated

with liver abscess. This has enabled Powell SJ, MacLeod I et al in the Amoebiasis Research Unit there to compare the efficacy of various forms of treatment, and to search for a drug that will heal both the intestinal and hepatic forms. They reported that the use of metronidazole, better known for its effect on trichomonal infections appears to be an effective treatment for both amoebic colitis and liver abscess. There were virtually no side-effects [11]. In our study most of the cases were managed with USG guided percutaneous aspiration (45%) or conservatively with antibiotics alone (30%). Pigtail drainage of abscess was necessary in 13.3% cases.

We also performed laparoscopic drainage of liver abscess in 8.3% patients. In only two patients (3.3%) laparotomy was done due to intraperitoneal rupture of abscess. Due to advanced imaging modalities, investigations and effective antibiotics liver abscess can be diagnosed early and treated accordingly. Due to which overall stay in the hospital has been reduced significantly. In our study most of the patients were discharged within 8 to 14 days (40%) followed by 0 to 7 days (31.66%).

Sharma MP, Rai RR et al did a study with an objective to determine the value of needle aspiration in uncomplicated amoebic liver abscess. It was a randomised case-control study with a minimum follow up of one year, comparing patients treated with drugs alone with those treated with additional needle aspiration. Clinical improvement was similar in both groups of patients. Improvement in haematological and biochemical variables and rates of healing of cavities were also similar. The authors concluded that chemotherapy with potent tissue amoebicidal drugs such as metronidazole is optimally effective in treating amoebic liver abscess, and in uncomplicated cases routine aspiration is not required.

Similar study was done by Hanna RM, Dahniya MH et al which emphasized percutaneous catheter drainage in drug-resistant amoebic liver abscess. Percutaneous catheter drainage (PCD) of 22 amoebic liver abscesses was done in 19 patients who had failed to respond to amoebicidal therapy. PCD combined with amoebicidal therapy not only expedited recovery, but was curative in all 19 patients.

There were no complications. So it was concluded that PCD is a most useful adjunct to drug therapy and recommend its routine use in the management of drug-resistant amoebic liver abscesses [12,13].

Original Research Article

Donovan AJ, Yellin AE et al did their work on hepatic abscess. They inferred that hepatic abscess—amoebic or pyogenic—can be diagnosed with great accuracy by either ultrasonography or computed tomographic (CT) scanning. For cases that fail to respond to therapy with amoebicides, closed drainage guided by CT or ultrasound is performed. If drainage of a pyogenic abscess is required, the preferable technique is with a percutaneous CT- or ultrasound-directed catheter.

Open surgical drainage should be reserved for those cases in which a celiotomy is required for other purposes or for the patient who has failed a course of appropriate antibiotic therapy and closed percutaneous drainage is not feasible. Rajak CL, Gupta S et al did a study that was designed to determine and compare the efficacy of sonographically guided percutaneous needle aspiration and percutaneous catheter drainage in the treatment of liver abscesses. Needle aspiration, if limited to two attempts, has a high failure rate [14,15].

In a similar study Barnes PF, De KC et al did a comparison of amoebic and pyogenic abscess of the liver. Sonography detected all cases of amoebic abscess and missed the lesions in 2 of 39 patients with pyogenic abscess. Abscess cultures yielded pathogens in 90% of cases of pyogenic disease, while blood cultures were positive in 50%. Five of 20 patients with positive blood cultures had additional organisms isolated from the abscess that would have required adjustment of antibiotics for optimal coverage.

The authors concluded that all pyogenic abscesses should be aspirated to guide antibiotic therapy. In amoebic abscess, the diagnosis was usually based on clinical and sonographic findings. Improved awareness of this disease may decrease morbidity and mortality from this treatable condition [16].

Thompson Jr JE, Forlenza S et al inferred that most patients were from countries endemic for parasitic disease. For assessment of factors that might predict metronidazole treatment failures, multiple parameters were analyzed. Of the factors evaluated, only timing of clinical response correlated with successful therapy. Therefore, early diagnosis of amoebic liver abscess in patients from endemic areas and treatment with metronidazole will result in successful therapy in 85% of cases. Surgical intervention or alternative medical therapy is indicated for those patients who do not respond after 72 hours of metronidazole therapy. Stain SC, Yellin AE et al studied modern treatment options for pyogenic liver abscess. Open surgical drainage has

been the treatment of choice for pyogenic liver abscess. The results of their study confirm that pyogenic liver abscess can be successfully treated with broad-spectrum antibiotics and aspiration or percutaneous catheter drainage. Open surgical drainage is reserved for patients in whom treatment fails or who require celiotomy for concurrent disease [17,18].

Ethical approval: Taken

Conclusion

Early diagnosis of amoebic liver abscess in patients from endemic areas and treatment with metronidazole will result in successful therapy in 85% of cases. Surgical intervention or alternative medical therapy is indicated for those patients who do not respond after 72 hours of metronidazole therapy. Complications of liver abscess and mortality rate has been significantly reduced due to early diagnosis and less invasive procedure.

If abscess cavity is larger and/or filling repeatedly, continued drainage of liver abscess with Pig tail catheter along with antibiotics is required. Laparoscopic drainage of liver abscess is a newer modality with fewer complications and can be used as alternative to open surgical drainage or in recurrent abscess.

What this study adds to existing knowledge: Earlier open surgical drainage was the mainstay of treatment. With advanced imaging modalities and antibiotics this approach has been shifted more towards conservative or minimally invasive procedures.

The modern day ultrasound and other non-invasive imaging techniques had greatly revolutionized the diagnosis and management of the liver abscess. Conservative management with IV antibiotics and USG guided percutaneous aspiration of liver abscess are most frequent treatment modalities used now; with fewer complications.

Conflict of interest: None declared.

Funding: Nil, **Permission from IRB:** Yes

References

1. Blumgart LH, Hann LE: Surgical and radiological anatomy of liver and biliary tract. London WB Saunders, 2000;3-34.
2. McCuskey RS, Reilly FD: Variant of hepatic anatomy, dynamic structure, and its regulation, *Semin Liver disease* 1993;13:45-18. *American journal of surgery* January 1973 Vol-125(1)70-79.

Original Research Article

3. Davis A, Pawlowski ZS. Amoebiasis and its control. Bull World Health Organ. 1985;63(3):417-26.
4. Sharma MP, Ahuja V. Management of amebic liver abscess. Arch Med Res.2000 Jul-Aug;31(4 Suppl): S4-5.
5. Johnson RD, Mueller PR, Ferrucci JT Jr, et al. Percutaneous drainage of pyogenic liver abscesses. AJR Am J Roentgenol. 1985Mar;144(3): 463-7. DOI:10.2214 /ajr.144.3.463
6. Rahimian J, Wilson T, Oram V, et al. Pyogenic liver abscess: recent trends in etiology and mortality. Clin Infect Dis. 2004 Dec 1; 39 (11):1654-9.Epub 2004 Nov 9
7. Seeto RK, Rockey DC. Pyogenic liver abscess. Changes in etiology, management, and outcome. Medicine (Baltimore). 1996 Mar;75(2):99-113.
8. Siu LK, Yeh KM, Lin JC, Klebsiella pneumoniae liver abscess: a new invasive syndrome. Lancet Infect Dis. 2012 Nov;12(11):881-7. doi: 10.1016/S1473-3099 (12) 70205-0.
9. Sabbaj J, Sutter VL, Finegold SM. Anaerobic pyogenic liver abscess. Ann Intern Med. 1972 Oct; 77 (4):627-38.
10. Ochsner A, DeBakey M, Murray S. Pyogenic abscess of the liver: II. An analysis of forty-seven cases with review of the literature. The American Journal of Surgery. 1938 Apr 1;40(1):292-319.
11. Powell SJ, MacLeod I, Wilmot AJ, Elsdon-Dew R. Metronidazole in amoebic dysentery and amoebic liver abscess. Lancet. 1966:1329-31.
12. Hanna RM, Dahniya MH, Badr SS, et al. Percutaneous catheter drainage in drug-resistant amoebic liver abscess. Trop Med Int Health. 2000 Aug; 5 (8):578-81.
13. Donovan AJ, Yellin AE, Ralls PW. Hepatic abscess. World J Surg. 1991 Mar-Apr;15(2):162-9.
14. Rajak CL, Gupta S, Jain S, Percutaneous treatment of liver abscesses: needle aspiration versus catheter drainage. AJR Am J Roentgenol. 1998 Apr;170(4): 1035-9.
15. Barnes PF, De Cock KM, Reynolds TN, et al. A comparison of amebic and pyogenic abscess of the liver. Medicine (Baltimore). 1987 Nov;66(6):472-83.
16. Thompson Jr JE, Forlenza S, Verma R. Amebic liver abscess: a therapeutic approach. Reviews of infectious diseases. 1985 Mar 1;7(2):171-9.
17. Stain SC, Yellin AE, Donovan AJ, et al. Pyogenic liver abscess. Modern treatment. Arch Surg. 1991 Aug; 126 (8):991-6.

.....

How to cite this article?

Krishnanand, Kurmi N.S.Clinical study of liver abscess. Surgical Update: *Int J surg Orthopedics*.2019;5(1):46-53. doi:10.17511/ ijoso.2019.i1.08.

.....