Isolated (Free) Omental Graft for packing of the residual cavity in solid organs (New modality, Multicenter-Egyptian experience)

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Abstract

Introduction

Basically, omentum is a highly vascular organ with a rich source of angiogenic factors that promote the growth of blood vessels into whatever tissue it is placed close to. The potent lymphatic system of the Omentum can absorb enormous amounts of edema fluids and remove metabolic wastes and toxic substances. [1]

Patients and methods

The present study is a prospective descriptive study involving 46 patients from 2016 to 2019 it is a multicenrer trial was conducted in 3 hospitals in cairo. All patients were followed up to one year postoperatively. All patients had a residual cavity after different operative procedures, due to different pathological causes , this cavity is filled by a Free Omental Graft (pedicless graft). U/S is repeated after 2 weeks post.operative and at three months intervals, then at one year a CT scan is done to assess the Free Omental Pack size and Density as well.

RESULTS

The Following variables were followed up in the postoperative period, the average temperature was 37,5 , The TLC was ranging from 5000 to 17000, the average was 11230. The CRP ranged from 7 up to 41, with an average of 18.83. The operative drain collected the avregae of 91.1cc (ranged from10 to 250cc) . The postoperative bed was followed up by early U/S assessment, which revealed no early collection detected in the studied patients. Peri pack collection was followed up, 39 (84.8) patients had no collection and only 7 (15.2) showed minimal collection.

ConclusionThe use of Isolated Omental Graft for Packing of the Residual cavity after surgery upon solid organs is safe effective, less time consuming with minimal morbidities with no change of size or character of the Isolated graft by time, which preclude any fear of graft necrosis as being an Free isolated graft.

Introduction

In the past, the omentum was considered to be an inert tissue without much biological significance. But since the beginning of the last century, innumerable studies and trials have been conducted by surgeons and scientists all over the world, which have proven

that the omentum is a unique, physiologically dynamic tissue with immense therapeutic potential.[1]
Basically, it is a highly vascular organ with a rich source of angiogenic factors that promote the growth of blood vessels into whatever tissue it is placed close to. The potent lymphatic system of the Omentum can absorb enormous amounts of edema fluids and remove metabolic wastes and toxic substances [2]
The most common use of omentum is as an adjunct to intestinal surgery, wherein it is often wrapped around the sites of anastomosis. The omentum fills in small gaps between the sutures and provides a good source of blood vessels and inflammatory cells for healing. The omental plug promotes healing through a combined process of inflammation, granulation, vascularization and fibrosis.[3,4]
Some surgeons have applied transposed omentum to improve the haemostasis during liver resections and to line the bed of hydatid cysts in the liver. [5.6]

In trauma, spleen-wrapping omentoplasty has been associated with splenorrhaphy or partial splenectomy as an effective spleen-saving procedure. [7]
Repair of defects in abdominal wall from the chest up to the perineum by omentum is practiced. [8]
An attempt of closure of Cerebrospinal fluid fistulas (CSF) was done by transposed omental free graft. [9,10] Brain vascularity could be improved by omental graft in patients with chronic ischemic cerebrovascular diseases and Alzheimer showing some cognitive and memory improvements. [11,12]. Reduction of aorto-enteric fistula formation can be achieved by omental wrap around the aortic anastomosis. Buerger's disease patients have shown improvemt after application of omental graft in terms of marked improvement of intermittent claudication and pain, ischemic ulcers healing and delay the progress of gangrene in upper and lower extremities due to the high neo-vasulature formation specificity of the Omentum.[13,14].

The autotransplantation for tissues in human bodies is declared from long time ago, the mostly common examples for this process are skin auto-transplantation and parathyroid gland, in both examples autotransplantations is done by an isolated graft without vascular reconstruction. [15] The most widely practiced method for parathyroid autotransplantation is authored by Wells et al, in which parathyroid is put in cold saline 4 ℃ . After being in cold saline for 30 min, the glands are firm enough to be sliced into 1 mm slices or 1 mm cubes., 10–20 pieces are inserted into a pocket of muscle [16,17]. Selective auto-transplantation of devascularized glands is an effective way of restoring parathyroid function and it protects against permanent hypo-parathyroidism. [18]

Ethical considerations

Our study is a prospective descriptive study, concerning patients operated in three surgery departments in Cairo.
All patients enrolled in this study had an informed consent before joining the study. They had all the rights to withdraw from the study without any interruption of their treatment plan and rights.

All personal data of enrolled patients are preserved and kept away from data retrieving personnel.

Patients and methods

The present study is a prospective descriptive study involving 46 patients from 2016 to 2019. All enrolled patients were followed up from day of surgery to one year postoperatively. The Study was conducted in three departments of Hepato-Bilio-Panctreatic (HBP) Surgery in Cairo (NHTMRI, EL Mokattam Insurance Hospital & Darelshiffa Hospital).

The inclusion criteria

Any residual cavity after surgery in the liver parenchyma (cavity in solid organ).

1. hydatid cyst of the liver
2. simple cysts of the liver
3. Space occupying lesion of the liver – tumors like (HCC) with cavity followed excision

Exclusion criteria

1. Lesions leaving Shallow cavities in the liver after surgery
2. Children with lesions are excluded from the study.
3. Patients had previous Omentectomy for any cause

All included patients in the study had the ordinary routine laboratory investigations pre-operatively, concerning the liver profile, renal profile, coagulation profile, complete blood picture, as well as CRP (quantitative type). They had a radiological assessment regarding their original lesion, in the form of abdomino-pelvic Ultrasound, and Dynamic CT study of the abdomen (Triphasic protocol in case of liver lesion).

During the operations, the lesion, the procedure, the total operative time, and the graft preparation & applying time (all these variables) were recorded. In the postoperative, the following parameters were observed and documented, Fever, Drains, collections.

Operated patients routinely had a systemic follow-up by a laboratory and radiological assessment at fixed times either in the early and late post-operative period.

The laboratory investigations post-operatively include the following

C.B.C (with differential counts), CRP (quantitative type), & clinically both fever and pain were observed.

The Radiological investigations include

Abdomino-pelvis U/S, Dynamic CT study.

In the Ultrasound post-operative, assessment of the whole peritoneal cavity for any collection, assessment of the Omental free graft size, echogenicity, peri-graft collection, intra-lesional collection or presence of air content in the Omental graft, or any other anomalies related to the procedure (vascular, etc..). The U/S scanning was repeated at intervals of D1,+/- D3, D7, D14, D30, then every three month for the first year

In the Dynamic CT study, assessment of the operated organ as well as the whole peritoneal cavity was asked for, assessment of the graft filling the residual cavity, regarding its size, density and the surrounding of the graft as well.

Technique of the procedure

All patients enrolled in the study had a residual cavity after different operative procedures, due to different pathological causes from Hydatid cystic disease of the liver (most common of our causes), {photo I} simple cysts, and tumours of the liver whether primary (Hepatocellular carcinoma,HCC), or secondaries (liver metatstases mainly from colorectal origion). After management of the primary cause of the disease,either by deroofing for the cyst {photo II}, or local excision of the tumour from the liver parenchyma, this results into a cavity in the liver parenchyma
{photo III}, this cavity is filled by a Free Omental Graft (pedicless graft), prepared and tailored from the Greater Omentum (Non Pedicle- Free Graft). The Free Omental Graft is chosen and prepared from the greater Omentum after dissection of a part of the Greater Omentum and freeing it, especially if it is attached to the abdominal wall from previous abdominal surgery {photo IV}, the free graft is tailored to fit approximately the size of the residual cavity. The Free Omental graft is kept in cold saline if prepared before the cavity was ready to be filled with it, but it is better to prepare the Free Graft just after finishing procedure and the cavity is ready to be filled.
Good homeostasis is realized to the residual cavity of the parenchyma before the free Omental graft is positioned and fitted into the cavity filling it. The Free Omental Graft is kept in place, in the cavity without stitches {photos V & VI}.
A routine drain is positioned in all patients, to be removed in the early post.operative from Day one up to Day three post.operatively.
The Follow up for patients is done radiologically by serial U/S assessment for the liver and the cavity filled with the pack as well as for the Free Omental Pack regarding its size, echogenicity (consistency), and peri graft and perihepatic collections. Laboratory nvestigations including CBC, CRP as well as liver profile for follow up of the original disease.
U/S is repeated after 2 weeks post.operative and at three months intervals, then at one year a CT scan is done to assess the Free Omental Pack size and Density as well.

Statistical analysis

Results were analyzed using SPSS (ver. 25.0; IBM, Chicago, IL, USA). Quantitative data was displayed in the form of mean ± standard deviation (SD). Qualitative data was demonstrated through figures of frequency and percentage. Qualitative data were expressed as percentage

Results

46 patients were included in this study, from them 34 male (73.3%), and 12 females (26.1%), the average age was 43.9.
The pathological causes for the operated patients were as follow, Simple Cyst in 5 patients (10.9%), tumour HCC in 12 patients (26.1%), and Hydatid cyst in 29 patients (63%).
Regarding the type of surgical procedure undertaken, 12 patients had enucleation (26,1%), and 34 patients underwent deroofing (73.9%). Table1, diagram 1 &2

	All patients (n=46)	
Gender N (%)		
Male	34	(73.9)
Female	12	(26.1)
Age (years)	43.96	(9.31)
Type of surgeryN (%)		
Enucleation	12	(26.1)
Deroofing	34	(73.9)
Cause N (%)		
Simple cyst	5	(10.9)
Hydatid cyst	29	(63.0)
Tumour	12	(26.1)

mean (SD) (min-max)

Table (1): Pre- operative characteristics of enrolled patients study

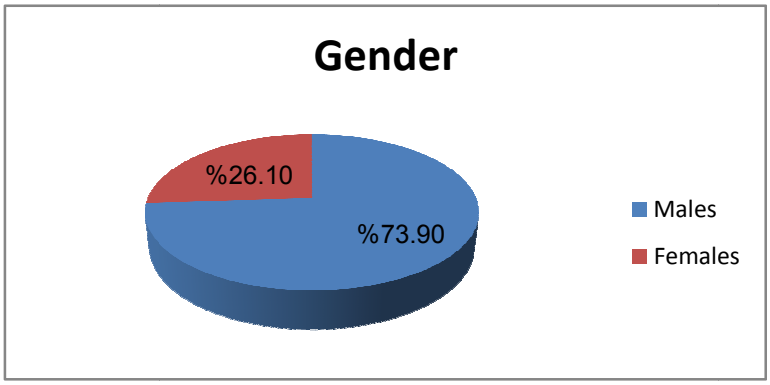

Diagram 1- Distribution of studied population by gender

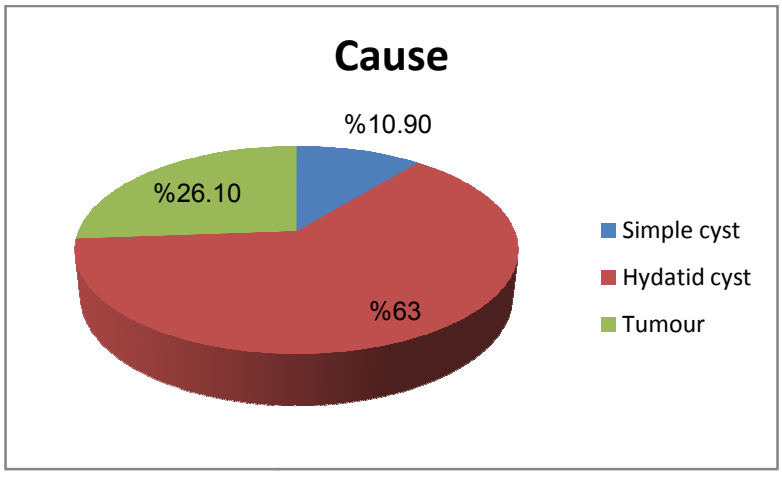

Diagram 2 - Distribution of studied population by indication for surgery

The duration of the intervention was average 137.8 minutes (ranging from 90 – 200Min), while the Omental Pack duration was ranging from 3 to 10 minutes with average of 4.93 minutes. Table 2

	All patients (n=46)		
Duration of operation(min)*	137.8	(27.2)	(90 - 200)
Duration of packing(min)*	4.93	(1.76)	(3 - 10)

*mean (SD) (min-max)

Table (2): Intra-operative assessment of patients

The Following variables were observed and followed up in the postoperative period, the average temperature was 37,5 (ranging from 36.8 to 38.8), The TLC was ranging from 5000 to 17000, the average was 11230.

The CRP ranged from 7 up to 41, with an average of 18.83. The operative drain collected the avregae of 91.1cc (ranged from10 to 250cc), it was removed in the first Day in 16 patients (34.8%), 22 patients had their drains removed in D2 (47.8%), while only 8 patients had it removed in D3 (17.4).

The postoperative bed was followed up by early U/S assessment, which revealed no early collection detected in the studied patients. Table 3 & diagram 3

	All patients (n=46)		
Body temperature(^{0}c)*	37.5	(0.56)	(36.8 – 38.8)
TLC(*3)*	11.23	(2.79)	(5.00 – 17.00)
CRP*	18.83	(9.11)	(7.00 – 41.00)
Drain amount(cc)*	91.1	(58.1)	(10– 250)
Drain removal afterN (%)			
One day	16	(34.8)	
Two days	22	(47.8)	
Three days	8	(17.4)	
CollectionN (%)	46	(100)	
No			

*mean (SD) (min-max)

Table (3): Post-operative assessment of patients

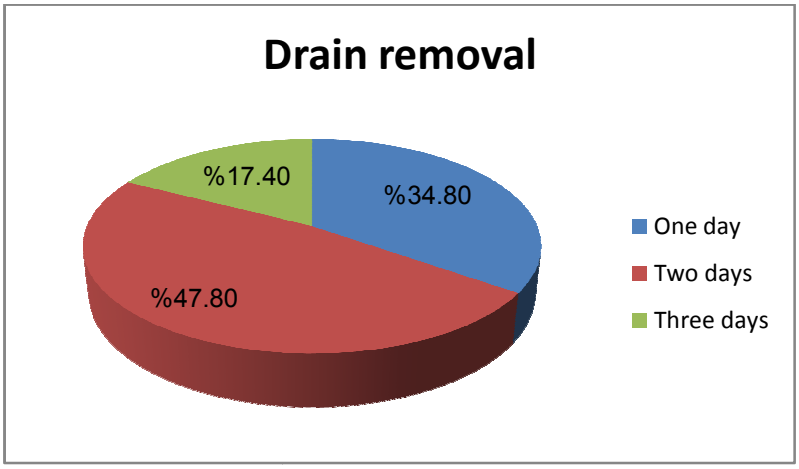

Diagram 3 - Distribution of cases by removal of drain

The Omental Pack was assessed in the early postoperative by repeated U/S. regarding the following criteria, the Pack size, echogenicity, that did not show any changes in all the patients. Peri pack collection was as well followed up, 39 (84.8) patients had no collection and only 7 (15.2) showed minimal collection and neither patient has had intra abdominal collection. Table 4.

	All patients (n=46)	
Size of packN (%)		
No change	46	(100)
EchogenicityN (%)		
No change	46	(100)
Peri- pack collection		
No	39	(84.8)
Minimal	7	(15.2)
Intra- peritoneal collection		
No	46	(100)

Table (4): Post-operative radiological assessment of patients

The U/S assessment for the free Omental graft packing was routinely done on D1, D7, D14 then D30, and followed by once monthly up to 6 months post.operatively (photos VII, VIII, IX & X – showed repeated U/S at different intervals without change of the radiological characters).

A routine CT scan was done for all patients on 6 months post operative, that showed a fixed density of the free Omental graft without change of size of the pack or any radiological abnormalities (as necrosis or collections). Photos XI, XII

Discussion

After surgical management of solid organs lesions (specially liver cysts and masses) either by deroofing or enucleation, the aim is to reduce the chance of recurrence and avoid any collection at the operative bed, it is used to put a pedicled omental flap to fill up the cavity created after the surgery, given the information of the ability of the omentum to resist infection, as well as its ability to angiogesis and neovascularization at the surgery cut-surface, which ensures its viability and ability to reduce recurrence due to collapse of the cavity. [19] It has been observed the ability of the omentum to adhere to intra abdominal foreign bodies or rough surfaces. The omentum performs many functions during peritonitis. The first is the rapid absorption and clearance of bacteria and foreign material from the peritoneal cavity. [20,21] The second is that the omentum provide leukocytes to the peritoneal cavity. In experimental animals with peritonitis, the omentum is the principal site to which macrophages and then neutrophils migrate to in the peritoneal cavity. (22) The third function is to adhere to and attempt to seal off areas of contamination. Then it rapidly produce a layer of fibrin by which adheres to the contaminated area at the point of contact. In few days time, the fibrin begins to form new blood vessels and fibroblasts (organise) . the contaminated area will be walled of by collagen, and dense adhesions develop (23,24).

Autotransplantation is a well known surgical procedure in different fields of surgery, it has been practiced for ages in patients after total parathyroidectomy by implanting score slices or cubes in the neck or forearm and it has proven success in preventing hypoparathyroidism post total parathyroidectomy. [25] As well skin grafting which is been practiced on daily basis another example of autotransplantion, an attempt of closure of Cerebrospinal fluid fistulas (CSF) was done by transposed omental free graft. Brain vascularity could be improved by omental graft in patients with chronic ischemic cerebrovascular diseases and Alzheimer showing some cognitive and memory improvements, that showed the efficacy of the free Omental Grafts to survive and function regardless its origional blood supply.(26).

Not every patient has suitable omentum for pedicled grafting after surgery leaving cavities, in some the omentum has been removed in previous surgeries, extensively adherent or congenitally small in size making creation of pedicled graft difficult, given this and the autotransplantaion feasibility, in the current study we used an isolated omental graft to fill up the cavities left behind after surgeryfor the solid organs (specially the liver), the study has proved the ability of the isolated omental graft to survive and to prevent any recurrence in any of the study cases furthermore the US and CT scan follow up of the grafts have not shown any change neither in size nor the echogenisity of the graft after repeated radiological assessment upon the postoperative follow-up period. No signs of infection have been detected in those patient postoperatively which should happen if the graft has necrosed in terms of rise in WBC and CRP.

Omentoplasty is one of the most effective treatments for septic lesions of costal cartilage and sternum like radiation osteomyelitis, this is an evidence that the Greater Omentum is an effective organ that resist as well as resolve the infection by its biological behavior adding to its ability to develop neovasculature rendering itself as independent organ for implantation without vascular supply. (27).

Conclusion

The use of Isolated Omental Graft for Packing of the Residual cavity after surgery upon solid organs is safe effective, less time consuming with minimal morbidities. There is no change of size or character of the Isolated graft by time, which preclude any fear of graft necrosis as being a Free (isolated – non pedicle) graft.

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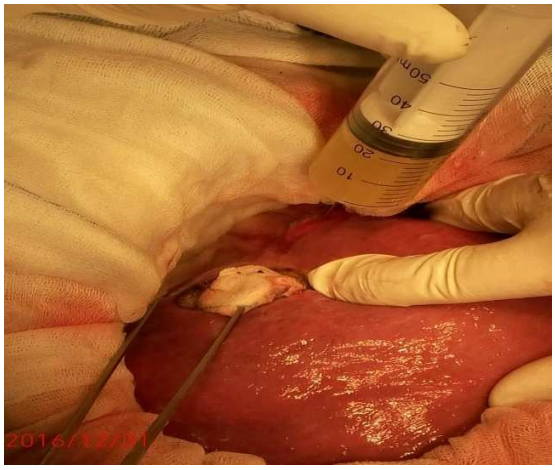

Photo I – Hydatid aspiration & Cavity

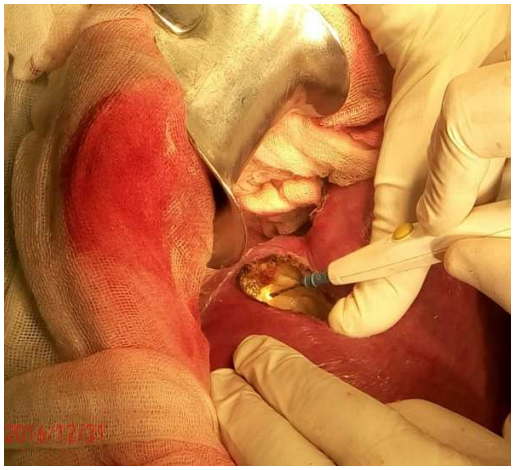

Photo II – Deroofing of Hydatid cyst cavity

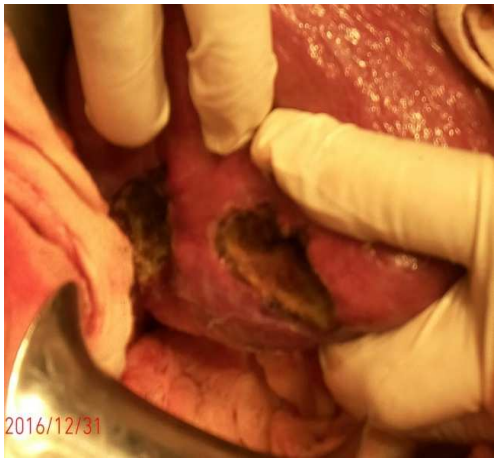

Photo III – cavity preparation

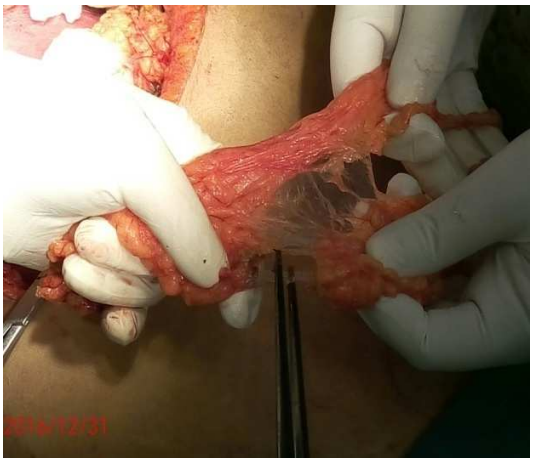

Photo IV – Free Omental graft Preparation

Photo V

Photo VI

Photos v & VI – the free Omental graft kept in place without stitches.

Photo VII --D3 post. Op.

Photo VIII --- D15 post.op.

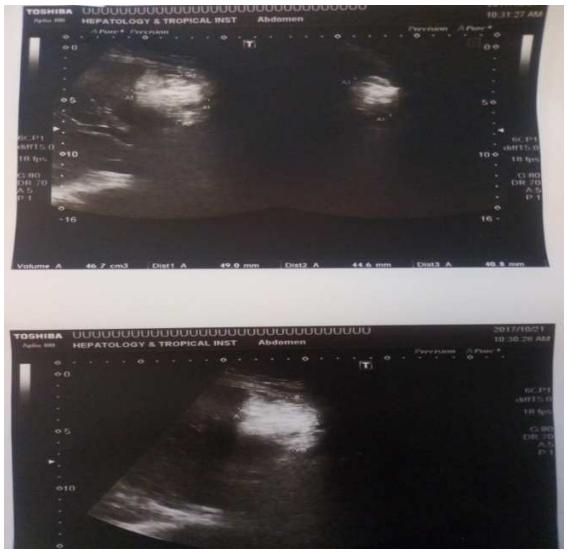

Photo IX – 3 months post.op

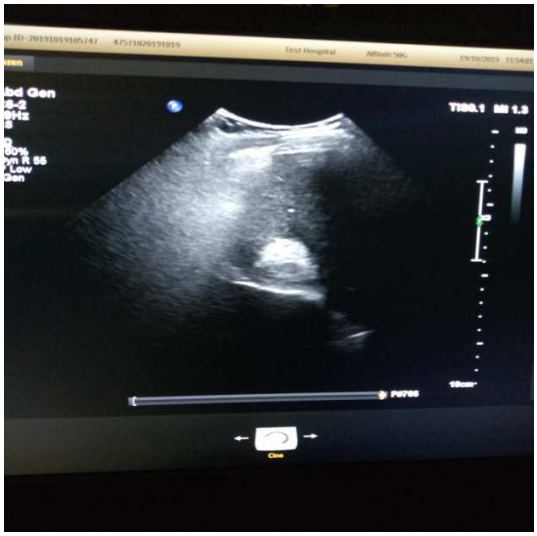

Photo X - 6 months Post.op.

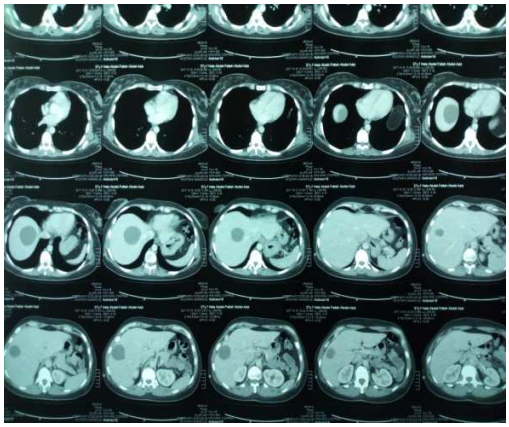

Photo XI – CT pre-op.

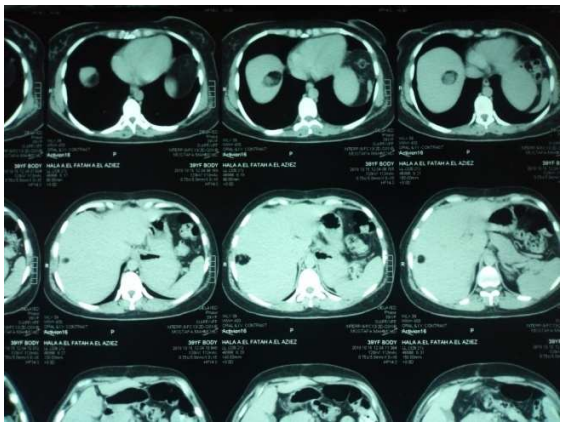

Photo XII- CT 6 months post.op.